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"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

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FACTS YOU SHOULD KNOW ABOUT ANIMAL DISEASES—AN ELEMENTARY TALK*

By K. F. MEYER, Director George Williams Hooper Foundation for Medical Research, University of California Medical School, San Francisco.

My talk has been announced as facts regarding animal diseases. Before I set forth in simple language some of the facts, let me consider what is meant by disease. Briefly stated disease is a departure from health or in other words, changes in the normal structure and function of the organs. The human or animal body can not adjust

* This and the next five papers were addresses given before the Third Annual Convention of Employees of the Division of Fish and Game held February 28–March 1, 1928, in San Francisco.

itself to factors which lead to the departure or to the variations in environment in which it must live. Whether these factors are climatic, electrical or mechanical in nature, or whether the changes are due to the invasion of certain types of microorganisms, or parasites or chemical disturbances, makes quite a difference in the picture of the disease. When the body adjusts itself to the various factors, no disease will result. For example, if a person is not affected by sudden changes in temperatures, infections of the lungs like pneumonia may never develop. If one adapts oneself to the typhoid bacillus, one does not contract typhoid fever. In the latter instance the adjustment is spoken of as immunity or resistance against the typhoid germ.

It is very interesting that in the past acute diseases have shortened the life span of men as well as animals. In the Stone Age the span was probably not more than 30 years. Preventive measures, the application of hygiene, etc., have increased it to about 56 years. Yet in certain countries in which infectious diseases are still prevalent the life span of man is still around 30. In this connection it is worth while to remember that aside from the prolongation of life—modern science has given us a much more useful and livable life. Just think for a moment, a man without teeth, or a man without eyesight in the Stone Age—meant death—his defects were absolutely fatal to his existence. Why? He could neither chew the available food nor could he evade the dangers to which he was exposed. Today, many of us with artificial teeth and with eyeglasses do not consider these manifestations of disease as a handicap although the loss of sight is certainly lethal for game animals.

That animals are subject to disease just as frequently as man, is a well established fact. In old documents dealing with hunting one finds various descriptions of destructive diseases of game, but since man was primarily interested in reducing his own mortality the interest in the maladies of animals has lagged considerably. Only when animals become domesticated it appeared important to control the disease to which they were heir. Today a great deal is known regarding the diseases of the domestic and the captive wild mammals and birds in zoological gardens (see Herbert Fox, Disease in captive wild mammals and birds; Lippincott 1923) and those animals which may be the reservoirs or the carriers of certain germs transmissible to man. I once spent a period of three years in Africa and studied some of the reservoirs of the sleeping sickness parasites. I became interested in the sickness of animals, not merely in order to protect man but in order to solve some of the fundamental aspects of disease processes. I wanted to know if wild animals died as a result of acute infectious diseases similar to those seen in man, or if they are subject to chronic disorder such as degenerations, fibrosis or hardening of the kidney, the blood vessels, etc. To my amazement I was forced to realize that chronic degenerative processes exist through the entire animal kingdom.

Our knowledge regarding the diseases which affect the game animals —mammals and birds—of this state is still meager and the study is very much in its infancy. We are organizing a group of investigators who will serve as a fact-finding institution. Only when we have facts can we hope to develop preventive and corrective measures. Any-

body who analyzes logically the findings which have been made will immediately appreciate that it is exceedingly difficult to do anything in a curative way. In fact it is well known that the medical treatment of a malady, even in man, is limited. We prevent today, we do not cure. Man recovers from disease without and in spite of the bottles of drugs or patent medicines which have been consumed or used. Unfortunately the layman continues to adhere to the belief that sickness must be cured by medicines. The suppression of disease among wild mammals and birds can rarely be accomplished by drugs. Preventive and not curative measures must be chosen.

If we analyze a disease what do we have to look for? There are first, the causes of disease. Second, lesions, or tissue changes which we may see with the naked eye or the microscope or by chemical means and third, disturbed functions which produce the so-called symptoms. For example, an attack of pneumonia instigates certain symptoms which enable the physician to recognize the nature of the disease. He records fever, a rapid pulse, difficult and superficial breathing, peculiar sounds in the chest, general restlessness, etc. The same applies to animals—their diseases produce disturbed functions and symptoms. It is always of greatest importance to record carefully any symptoms which may be noted since they may aid in the recognition of the malady. In poisoning cases there are definite disturbances. And again in a lingering disease, the wasting away, the restlessness or the dullness toward the outside are significant manifestations. Most of you living out of doors and endowed with a very keen sense of observation can help us a great deal by recording faithfully the symptoms of the diseased game. Let me illustrate this point, there has always been a debated question whether deer may die when they harbor bot fly in their nasal passages. The question: Do the fly larvæ obstruct the air passages leading to the lungs, and is death due to suffocation, or may some of the bots be aspirated into the lung tissue producing pneumonia, and consequently do the animals die from secondary infections asquired by the aspiration of the bots, was solved by a careful study of the symptoms and the lesions. One observer noted that the ground surrounding the dead deer was disarranged and had every earmark that the animal had struggled in an attempt to breathe. The post-mortem proved the diagnosis suffocation—the upper air passages were completely blocked by the fly larvæ but the lungs were free from lesions. In another case, similar to the one Mr. Ludlum brought to my laboratory, the bot fly had been caught in a branch of one of the air passages of the lung. It had obstructed a portion of the lung, but since it also brought bacteria from the nasal passages it caused aseptic pneumonia, and the deer had died from general blood poisoning. In this case the animal was ill for several days, but died without a struggle.

If in any way possible, the disturbed functions should be observed. Naturally, in many cases we can not apply modern methods of examination. We can not go around and use a thermometer; we can not thump the chest to see if the animal has pneumonia. But you should keep in mind that symptoms may furnish excellent leads in a study of the causes of sickness.

Now comes the next important step in the study of disease—the anatomical lesions and tissue changes. In order to establish the

lesions one must perform a post-mortem examination or autopsy. Such examinations should be made as soon as possible after death. Particularly in wild animals it is always essential that only fresh carcasses be examined, since the invasion of microorganisms from the intestinal tract lead rapidly to decomposition of the tissues and to changes in color, consistencies, etc., of the organs. A decomposed cadaver or tissues are utterly useless for any serious investigation of any sort. You can save yourselves the trouble of a post-mortem and the expense of shipping such tissues to the laboratory. If you can not perform a complete post-mortem immediately after death, remove at least the intestines from the body and separate them from the spleen, liver, etc.

A post-mortem examination should be done by somebody who knows what is normal and who can recognize what is abnormal, preferably an animal pathologist. In order to perform a perfect post-mortem a great deal of experience is required, which can be acquired only by the opening up of every dead animal. One should do that on every occasion. I do not claim to have a thorough knowledge of the anatomical makeup of every bird or every wild mammal, consequently I always ask the people who submit animals or organs for a post-mortem examination, that they give me an opportunity to see a healthy animal of the same species. Thus I familiarize myself with the shape, sizes, etc., of the organs and my mind is then prepared to detect abnormalities.

I have many times been amused when performing post-mortems before inexperienced persons. For example, I opened up the mouth of a deer and somebody standing around said, "now look here, this animal has no incisors in the upper jaw." To them a perfectly normal condition was already a definite lesion. I once saw a group of students searching a whole morning for the gall-bladder in a deer. Furthermore, there are certain conditions in the lungs of animals—the amount of fibrous tissue which is between the air sacs—which are of greatest significance in judging the permanent damages produced by pneumonia. These examples probably suffice to emphasize that the game warden and hunter should examine healthy animals before they attempt a diagnosis of the lesions in a diseased animal.

Now what should you do when you perform a post-mortem? I will give you some of the essential steps since in many instances we shall have to depend upon your work and observations. You are going to send us the organs of the animals in order that we may determine the cause of death. Therefore, every observation you make is of greatest importance. You open up the abdomen; you note first the arrangement of the organs; the location of the stomach, the intestines, etc. There may be various disarrangements in the position to the cavity or in the organs to themselves. If you can not describe what you see, make a sketch. In case you have an idea regarding the cause of the disarrangement write it down in simple language. Then take out the organs, the spleen first, then the liver, look at it; is the size normal or is the organ enlarged? What is the color; dark or light brownish, rich in blood? Is the surface smooth or rough? What is the consistency; hard, soft or friable? Then make an incision and note if the blood oozes from the vessels, if it contains gas bubbles, is it partially clotted, etc.? All these things have a definite meaning. Then you prepare the organs for shipment to the laboratory. Do not send

pieces but send the whole organ. The best thing is to wrap each organ separately in a clean cloth. Don't wash the tissue in water, more bacteria which favor decomposition and putrefaction are added. If you have bichloride tablets soak the cloth in a 1:1000 solution. Place the wrapped organs in a box with sawdust, or excelsior, or straw, or any absorbent material and ship to the laboratory by express. Small organs may be packed in glass jars and shipped on ice. During the summer months ice should be used freely.

In the course of a post-mortem examination one should always follow a certain procedure in taking out the organs. One should never open the intestines before one has removed the other organs of the body. The best thing is to take out the spleen first; then the kidneys; lungs and heart, possibly hanging together; liver and then the intestines. Never forget to examine the bones of the limbs, chest and the muscles, the skin and the natural openings. Under certain special conditions it may be advisable to send the head so that the brain, the eyes, etc., can be examined.

In reporting your findings, you should be strictly objective; never let yourself be guided by impressions. The best procedure is merely to describe what you see. For example, if you note a tumor or swelling, just state that it was the size of an apple located in the center lobe of the liver or the left lung, that it was hard, uneven and whitish, rather gritty when being cut, etc.

The recording of the gross lesions is a very important part of a post-mortem since it serves as a guide for subsequent investigations.

When we have determined the lesions, we naturally want to know the causes of the abnormal structure and function.

The causes of disease are numerous.

There are first the group of (1) *mechanical forces,* factors causing injuries—for example, shot wounds, fractures, hemorrhage, etc., due to accidents. The lesions induced by mechanical forces are of greatest importance in finding the cause of death since not infrequently an injury sustained many weeks or months before may be followed by complications due to bacteria, etc. Then we have secondly the lesions due to (2) *electrical forces.* Injuries due to lightning strokes are the same in man and animals—sometimes internal, sometimes external. Birds succumb frequently to the effect of power currents with an electromotive force of 500–800 volts. Then there are the (3) *thermic changes* such as heat and cold, which affect wild animals rarely since their organism can readily adjust itself. (4) *Injurious chemical substances or poisons* are fast becoming very important causes of death among game animals. This group produces not infrequently few and indefinite changes and is rarely recognized without finer laboratory studies. The effects of some poisons are known, but in the group of plant poisons there still exist many mysteries. To illustrate this statement I will briefly describe a South African disease called lame sickness or lamziekte. In the course of this disease, ostriches, cattle, etc., develop a general weakness, a paralysis of the limbs; they are unable to get up or to raise their heads. This disease was a mystery until it was found that the soil on the Lamziekte ranches was poor in phosphorus and that on account of the deficiency the animals developed a desire to eat bones and carrion—in fact anything which contained phosphorus

and lime. They developed into bone-eaters and had a disease known as osteophagia. Studies were then made on the carrion bones and to the amazement of the investigators it was found that they contained a bacterial poison similar to that of botulism found occasionally in home-canned food. The decomposition of dead animals and the formation of carrion led to the generation of the poison. As soon as enough bone meal was placed on the Lamziekte ranches the animals had no desire to eat carrion and the disease was stopped automatically. It is not unlikely that similar types of poisonings may occur in game animals. We do not know the cause of the duck disease in California. The leg and wing weakness is probably not a true paralysis since birds transferred to fresh water make not infrequently an uneventful recovery. Aside from bacterial toxins, plant poisons, venoms and other organic and inorganic substances may act as chemical causes of diseases.

In a discussion dealing with the causes of disease among domesticated animals a large part is taken up by the (5) *infections* caused by plant parasites, such as bacteria and fungi. The number of diseases due to bacterial infections of game is very small, this must in all probability be ascribed to the mode of living. When many animals of certain species live together the chances for localization and multiplication of disease producing germs are favored and infectious diseases due to bacteria may make their appearance in epidemic form. Isolated cases of disease due to molds—particularly skin or lung infection—are sometimes found in game animals. The lesions are rarely extensive. Parasitism due to (6) *animal parasites* play a very important role as causes of disease. Insects and worms of various sorts are rarely missed on game animals. They produce general disturbances, but only massive invasion may lead to fatal processes. Not infrequently the consequences of parasites are overestimated. The study of the life cycles of the parasites is very important. We are always interested to know their portal of entry into the body—if the skin, the lung or the digestive tract. Are there any intermediary hosts? Where do game animals contract the parasites? Have certain worms a specific ability to localize in certain tissues and why? All these questions can only be answered by tests conducted in the laboratory.

Not infrequently the cause or causes of a disease are not readily apparent. For example, the duck disease of California requires extensive chemical tests before we can prove the so-called alkali poisoning theory. If we solve this problem in the next five years we will congratulate ourselves.

When we have considered the causes of the various infectious diseases, we are naturally interested in the behavior of some of the causes on a large group or congregation of animals. Thus far we have merely considered the individual. If one person contracts pneumonia, the health officer is rarely interested, but when hundreds of people exhibit the same malady, as they did for example in 1918, then we are entitled to become alarmed since we are confronted with the epidemic form of influenza.

What is an epidemic disease? It merely means that a large number of persons or animals in a community or reservation are affected by the same cause in a short time. What happens when an epidemic sweeps through an animal population? Certain interesting things

have been noted. I can best illustrate the facts by reciting a set of experiments which we conducted several years ago. We placed about 150 healthy white mice in a large cage. They were fed a balanced diet; they had plenty of ultra-violet rays and the cages were regularly cleaned. Then we placed in the cage a mouse which was infected and discharged mouse typhoid bacilli in the feces. We watched the cycle of events. After an elapse of a week a few mice appeared ill, the coats were rough and the eyes closed by crusts. Two or three days later the sick animals died and within the next four weeks a total of 120 of the 150 mice had succumbed to a mouse typhoid epidemic. The population was nearly wiped out, but what happened to the survivors? We studied them and found that 16 harbored the mouse typhoid bacilli in the intestinal canal, spleen and liver. They were so-called disease carriers and potentially capable of spreading the infection. If we had taken one of those carriers and put it in a cage with healthy mice, the carrier would have started an epidemic of the same character. In another experiment we placed a number of carriers in separate cages and added every ten days ten healthy mice. They contracted the disease, some died and some survived, but the mouse typhoid epidemic could be kept going as long as new mice were added.

In the first experiment 14 mice which survived failed to show mouse typhoid bacteria in their organs. To all intents and purposes they were immune. They either had contracted the disease, recovered and eliminated the causative microbe from their system, or they were hereditarily immune and could never contract the disease. The latter observation is very interesting since one can experimentally prove that the mating of resistant mice may give rise to a generation of highly resistant rodents in which the mortality from mouse typhoid is relatively low. If the survivors are mated again, the resistance is again slightly increased and so on. In this manner a mouse population highly immune to disease can be raised. It is not unlikely that similar factors may operate in the spread of an epidemic among game animals. Then again the present resistance to certain bacterial infections may be due to the transmitted immunity which the great-grandfathers acquired in the course of an epidemic. For the present we lack, however, the necessary proof. It is, however, important to keep in mind that an epidemic disease with a high mortality always produces carriers and reservoirs of the disease and no assurance can be given that quite unexpectedly a flare up may occur when susceptible animals come in contact with these carriers.

These conditions have been noted in epidemics among human beings and domesticated animals. Every 25 years epidemic influenza reappears. Certain definite biological laws govern the course and trend of the epidemic disease. In order to control them we must know the mode of transmission, etc. Promises are made that a given disease may be controlled although the cause of the disease is unknown. Expensive procedures are outlined only to be discredited six months later by the negative results they produced. For example, it is practically impossible to eradicate Rocky Mountain spotted fever, since the tick infested areas can not be freed from the insect. The same applies to ground squirrel plague and to the jackrabbit disease, tularemia. The only thing we can hope is to keep the infections at a low level and

thus reduce the chances of contact infection among a scattered rodent population. Even when every precaution is taken, recurrences do take place. Why? The answer remains one of the many unsolved problems.

That brings me to the last point. The examination of diseased animals is always connected with a certain amount of danger. In this state we have at least two diseases of wild animals transmissible to man. The jackrabbit disease—tularemia—and plague in ground squirrels. When you open up a jackrabbit and you note white spots on the liver and pus under the skin, bury the carcass and wash your hands most carefully with antiseptic solutions. In fact, it is a wise policy to wear rubber gloves when you examine suspected rabbits.

Tularemia is an unpleasant disease. To date there have been 430 cases with 18 deaths in the United States. Relatively few human cases have been noted in California, but the disease is common in Nevada, and is known in Utah as "deer fly fever." The causative microbe was first seen in ground squirrels caught by the United States Public Health Service in Tulare County. That is the reason why the germ responsible for the disease is called Bact. tularense and the malady tularemia. It is noteworthy that everybody who worked with this microbe in the laboratory became infected; in all, 20 cases of tularemia have occurred among laboratory workers. In the Lister Institute in London they desired a culture of the bacterium, which was sent to them by the Hygienic Laboratory, United States Public Health Service. They experienced difficulties in growing the microbe in culture and therefore undertook some experiments on guinea pigs. In a few weeks three workers of the laboratory had contracted the disease. In the light of these observations the need of some care is obviously indicated.

As far as plague is concerned the following should always be kept in mind. Ground squirrels with abscesses under the skin, or spots on the spleen, may be infected with the plague bacillus, which is transmissible to man. The experiences in Oakland in 1919 leave no doubt that a very dangerous form of plague infection, namely, the pneumonic or "black death" type, may result from such sources. In case a person develops boils after he has skinned rodents, he should always consult a physician without delay.

In closing, let me assure you of my cooperation. I am at the service of the state. You furnish the material and the problems. Even a small specimen well preserved will be of great value leading to the recognition of the causes responsible for certain diseases among animals. Always remember we can only conserve animal life when we know more about disease and the causes of death.

OUR POLICIES

By Eugene D. Bennett, Executive Officer.

I want to talk to you for about twenty minutes, to tell you of some of the things I have in mind. As to the plans before us, there is nothing revolutionary, nothing strange or unusual. There will be no upturning nor any grand upheaval. The principal thing I can do as I see it in my capacity as executive officer is to carry out the work as it has been organized and outlined, constantly striving to improve

wherever improvement may be made and to correct mistakes where they occur.

Many of my friends think this position as executive officer is a sinecure. Now I have been with this work for three months and feel that it is one of the biggest jobs I can conceive of today, and as time-consuming as any position I have had. The only compensation is that the nature of the work is pleasant. One is building here a good constructive future dealing with live things and live issues, and associating with a splendid group of men and women.

My part is to act as executive and to assist department heads in accomplishing the program and general plan of action the commissioners have given us. I am impressed with the tremendous responsibility I have upon my shoulders. Furthermore, I realize, being new to the work, that much of it is technical in its nature. I feel in this sense I am ill prepared to act as an executive for this great undertaking. There is compensation, however, in the fact that the men who have been selected to carry on their part have been at it for a long period of time and have dedicated their lives to the service.

Public service is a hard task. It is a hard task in any office if done right. In this task we have to work just as hard as in any other service of the state government. When you enter the state service and take the oath of office, it means you place yourself in a different position than you ever had before. You do not possess the right to do or think just as you would like to do or think on all occasions. A man in the field has certain duties to perform and has those duties to uphold. If necessary, he must even take action against his friends. The only way I see, men, is do your duty, assume the responsibility willingly, enter the field of your endeavor, entirely divorcing the selfish instinct. This is the only way of satisfactorily carrying on this work.

I know it is difficult to go out into the field at night and more comfortable to stay at home. However, you are a public servant. You are following a service to your community and state. I hope you will find me square and honest and I hope at all times you will never find a grain of prejudice in my make up. I can not make promises, because I believe it unfair. All I hope to do is do my level best, give the best of what is in me in every possible way, carry out the fine work as outlined, directing the great enterprise we have before us, and adjust the little difficulties which arise among us, keeping them within the organization and later solve them in a fair and just manner. Perhaps criticism may be directed to you and a reprimand from headquarters sent out, but if such happens it will be entirely official. I shall not let any personal feeling enter on my part or let any influence affect me whatever. All I want and ask is that you give your best, honest industry, in attempting to do your duty as laid out for you to do and I am sure you will get the great satisfaction that comes from conscientious work well performed.

It is a year-round proposition and you will always find that we people in San Francisco are thinking of you out in the field; we are thinking of your problems; we are thinking of your particular work which you have before you. Just remember we are here to serve you and help you carry out your work, and you are not given your commission merely to serve us.

I trust this convention will be successful and you will go away having gained something by it. That is the only reason we have you here today. Feel at all times, whenever we in San Francisco can be of real help to you, that you can come to us with any just cause of complaint, your troubles and problems. Do not try to influence any of us with unfair tactics or procedure, but keep up the *esprit de corps* this Commission should have. If you do not do your duty properly, you can not fit into this fine organization. You should have courage and individual sense of pride in your work; if not, enter your resignation, or, if you stay, enter into the fine spirit of it, *the spirit to serve and the will to do.*

POSTING OF GAME REFUGES

By J. S. Hunter, Assistant Executive Officer.

In 1902, a constitutional amendment was adopted, giving the legislature the right to divide the state into fish and game districts and to adopt appropriate legislation for the protection of fish and game within those districts. It was not until 1913 that this amendment was made use of by the legislature. At this time the state was divided into game districts in which there were different laws for the taking of various species.

In 1915, the district act was amended so as to provide for the creation of smaller districts. Section 626*s* of the Penal Code set these districts aside as game refuges in which all hunting and even the possession of game was prohibited. The Commission at that time did not have the funds to properly take care of the refuges through the employment of resident deputies whose duty it would be to see that the various provisions of section 626*s* were not violated.

It was not until the adoption of the increased license bill that we were assured that refuges could be properly patrolled. Last year an item was included in our budget providing for the posting of refuges. This meant that a crew of men could be appointed whose duty it would be to survey the boundaries of the refuges and to post signs warning the general public that hunting in that particular area was prohibited.

We were unfortunate in the first crew that we selected, but at the present time the crew is working excellently and has already surveyed refuges in the Sierras and in the coast from Marin County down south to Los Angeles County. I will read from the log of the man in charge of the refuge crew. This will give you an idea of something of the work that the boys are doing.

"February 10. Went to Solvang. Met Deputy Lyons, who put me in touch with rangers who all agree that the only practical method or procedure was to get a pack outfit and that would take about eight days to make the trip. Lightened up the truck as much as possible and then drove to the ranger station, seventeen miles above Los Olivos, seven miles of which is very steep and very rough road. Thirty-five per cent over grades. All of seven miles in low gear and in some places were just able to make it. Met packer and Mr. Tunnel and made arrangements to wait one day for him to get stock and have them shod.

"February 11. Went out with ranger to get a general idea of the country in the forenoon, and in the afternoon arranged for a pack of food, etc.

"February 12. You will note that the crew is working Sunday as well as every other day. Rode fifteen miles over steep trails to Manzana Creek, the south line of the refuge; then about five miles in an easterly direction up the Manzana, posting as we went along. Made camp at 4 p.m. at point near where the trail leaves Manzana. Saw seven deer along trail outside of refuge and a few mountain quail.

"February 13. The packer and Gurley and Young started across the refuge on trail to Hurricane Deck and the lower end of the South Fork of the Sisquoc River, while I took the canyon of the Manzana on foot and followed it and posted to the summit of Pine Mountain, six miles. No trail, rough going and very steep, encountered snow about two miles from summit, which was really more of a help than hindrance, as it was hard enough to hold and helped smooth over the rough spots. From the summit of Pine Mountain down the South Fork of the Sisquoc I posted about six miles, which took from 1.30 p.m. to 7.20 p.m. No trail and very steep going from one large boulder to another through about four miles of snow from eight inches to three feet deep and eight to ten feet in the drifts. I would not advise anyone to take this trip alone again owing to the danger element. I took several bad falls in trying to make time in the snow. Saw six deer, mostly on the snow line. This hike is from an elevation of about 3000 to 7000 feet. Saw several mountain lion tracks (Jay Bruce, please note) and one bear track on the top of the mountain. The boys saw, on their trip across the refuge, 150 deer and seven flocks of quail of from twenty to twenty-five in a flock, all at about an elevation of 3000 feet. They arrived at camp on the fork of Sisquoc, about one-half mile above the main river, at about 2.30 p.m."

These field notes will show you the character of information we are getting from the refuge crew. They are instructed to keep their eyes open and give us full and reliable notes regarding the abundance of game in all of the sections in which they work. They are also securing information relative to changes that should be made in the boundaries of the refuges. In other words, we are getting somewhere with our game refuge system and I would ask that whenever the crew works in the vicinity where any of you are located, you would help them to the fullest extent just as deputies Lyons and Emerick already have.

VOLUNTEER DEPUTIES

By Walter R. Welch, Captain of Patrol in charge of Volunteer Deputies.

Among the many duties that are assigned to the Fish and Game Commissioners is that of strictly enforcing the laws for the protection and conservation of fish and game that have been enacted by the state legislature. For that purpose the Commissioners are empowered by the provisions of section 642 of the Political Code of California to appoint, with or without pay, such deputies as they may need to discharge their duties in the enforcement of the fish and game laws in a proper manner.

Realizing that the regular salaried deputy forces of the Commission are not sufficient in number to properly patrol the game fields and streams for the strict enforcement of the fish and game laws throughout the state, the Commissioners have availed themselves of the law, and have appointed a number of men to act as volunteer deputies of the Division of Fish and Game.

As a former experience of the Fish and Game Commission with volunteer deputies in this state, as well as that of similar commissions in many other states, has proven that unless controlled by rules and system the majority of men appointed as volunteer deputies are a liability rather than an asset to the state in fish and game law enforcement, the Fish and Game Commissioners of this state have established a system for the appointment and supervision of the activities of all volunteer deputies of the Division of Fish and Game.

Under the system and rules adopted by the Commission for the control of volunteer deputies, the appointment of each volunteer deputy must be sponsored by a bona fide fish and game protective association or club.

The application and recommendation for appointment of each volunteer deputy must be endorsed by the captain of patrol of the district where the applicant resides, and be approved by the captain of patrol in charge of volunteer deputies.

Each volunteer deputy must be bonded to the state in the sum of $2,500 for the faithful performance of his duties, and is required to report monthly to the captain of patrol in charge of volunteer deputies, giving a full account of all of his activities during the month, such as number of hunting and fishing licenses checked, miles of game fields and streams patrolled, arrests made, fines imposed, etc.

California is the first state to undertake a system and rules for the control and supervision of the activities of men appointed as volunteer deputies for the enforcement of the fish and game laws.

Although the work has been pioneering in nature and at this time has not been completed, the result has far exceeded the hope of the Commissioners. At this time there are about 650 volunteer deputies within the state. About 375 of these deputies are federal forest rangers, and their appointment as volunteer deputies of the Division of Fish and Game is sponsored by the U. S. Forest Service. The appointment of the balance of the volunteer deputies is sponsored by various fish and game protective associations or clubs throughout the state.

At this time the volunteer deputies in twenty-one counties of the state have been organized and instructed in the discharge of their duties, and are now working under captains in cooperation and coordination with the regular patrol, with very beneficial results in law enforcement, and fish and game protection, as is evidenced by the fact that many arrests for fish and game law violations have been made by volunteer deputies, in which cases fines of from $25 to $250 have been imposed.

As cooperation is the keynote to the successful operation of any business, and as the enforcement of the fish and game laws, and the protection of fish, game and wild life is a business, and a big business, of interest and value to all of the people of the state, the cooperation of

the people with the regular patrol and the volunteer patrol is very necessary, and will result beneficially to the efforts being made by the Fish and Game Commission to restock the depleted game fields and public waters, and to protect and conserve the supply of fish, game and wild life.

A CONTINENT-WIDE WATERFOWL CENSUS

By Harry C. Oberholser, Biologist, U. S. Bureau of Biological Survey.

It gives me a great deal of pleasure to stand before you today, and to look into the faces of the wardens of the great State of California, because you and I are working for the same cause. We are trying to do what the country would have us do, not only in this state but in all other states—to preserve what we have left of the out-of-doors, and also to keep for ourselves and for posterity the great sport and recreation of hunting. It goes without saying that without any birds to hunt, without any other animals to hunt, there can be no hunting. Hunting and fishing are a little different from the pursuit of many other things in life. The real joy of hunting is the pursuit rather than the getting. You have seen a man sit on a log for a whole day and not catch a thing, go home and tell his friends what a wonderful time he had fishing. Much the same may be said with regard to hunting.

A few words might be said regarding what the Biological Survey is trying to do. The federal government and the state governments have distinct niches in conservation work. The federal government does not wish to take any of the glory of the states, rather is attempting to add to it; and the work of the federal government, including the Biological Survey, the Forest Service, and Bureau of Fisheries, is to help the states to coordinate their different activities with each other state, and to those things that require work in all the states for their best accomplishment.

Cooperation is particularly important in connection with the migratory horde of waterfowl that goes from state to state, from country to country, as a matter of fact from Canada to Mexico, for each one of our states must know what is going on in other states, and must cooperate with other states in order best to do its own work. It is to forward this cooperation that the Bureau of Biological Survey is working. We have felt for some time that there is a great lack of knowledge regarding waterfowl, particularly concerning their numbers, movements, and distribution.

Your state commission is making an intensive study of the duck sickness, and the Biological Survey is working along the same lines, but much remains to be accomplished. Another of the most important problems is what should further be done for the conservation of our waterfowl. There are several things that we need to find out before we can attack this problem with any degree of intelligence, or with any hope of success. We must know where the birds are, in what numbers, when they occur, and whether they are increasing or decreasing. As a matter of fact, we know but little. We have tried a number of means to obtain such information, but have found them unsatisfactory.

We have now decided to attempt what has never been attempted before —a comprehensive continent-wide census of the waterfowl, once a month. That may seem like a hopeless task, but it is not as hopeless as it looks, and it promises very important results.

The method of procedure is to gather information regarding areas in which waterfowl are found, and to get persons who know the ducks and geese to take the census regularly. Our purpose now considers only ducks, geese, swans, and mud-hens. Each individual who is willing to cooperate is asked to select a certain area, as much as he can cover in one day. He is to make a careful count where numbers are small enough, or an estimate if the number is too large to count, of each kind of waterfowl on that area, on a certain designated day each month, so that there may be no duplications. Waterfowl travel fast, so we must count them all on the same day. In this way, we shall have a census, or a stock report you might call it, each month, of the waterfowl of the North American continent. We have been organizing and conducting this work since August. Game wardens, game commissions, sportsmen's organizations, individual sportsmen, and others interested are being asked to help.

We started in August with 500 observers throughout the North American continent, today we have 2700. With even that number we can not adequately cover many of the large areas like California. We need your support and help in your great state. Our purpose is to enlist your support and interest; and our hope is that you will become interested in the waterfowl census, and come to see it as not only something the federal government is doing, but something that in your own state is needed to forward the very work in which you are interested. It is our purpose to make all the information available. Not only the information gathered in your state, but in all states will be available for your commission and for you. If the Biological Survey can help you in any way to increase the waterfowl and preserve the sport of hunting, that is our desire and we ask your help to that end.

CALIFORNIA TROUT

By J. O. Snyder, Stanford University.

Under the authority of the Fish and Game Commission, I have been for some time engaged in an investigation of the salmon of the state, and during this time considerable data have accumulated which relate to other species of fish, particularly the trout. I have examined some thousands of them, large and small. There are notes of a descriptive character, scales, anatomical structures and preserved specimens laid away against the time when they may be used to advantage. Certain conclusions relating to growth, distribution and relationships, which will no doubt be of value in propagation and conservation, are foreshadowed by these data, and of some of these I wish to speak.

In an oral discussion of this sort I may fail to always distinguish between fact and fancy, but I shall try to use the words theory, guess or presume, where they are most needed.

We have at hand a theory of geographic distribution and relationships of the trout of the state which I think is of value, perhaps even in artificial propagation. We have in the state the finest trout in the world. Some of them are the most beautiful in color, and they possess the finest qualities as game fish. They exhibit great variation in anatomical characteristics and they are adapted to extremes of climatic conditions. We have alpine forms in the region of the high Sierra, subalpine species adapted to the streams draining the higher slopes of the mountains, and transition forms near the sea level.

Among the alpine forms is the royal silver trout of Lake Tahoe and the Tahoe cutthroat (*Salmo henshawi*). The former is a deep lake form whose habits are unknown, while the latter is adapted to more general fluvial and lacustrine conditions. Related to the Tahoe cutthroat is the Columbia River cutthroat (*S. clarki*), which reaches the northern coastal region of the state, entering the streams as a steelhead, as far south as Redwood Creek and perhaps Eel River.

It was presumed by its describer that the royal silver trout (*S. regalis*) is related to the rainbow trouts which inhabit most of the larger streams of the state. They, the rainbows, are on the whole larger scaled forms than the cutthroats. The coastal rainbows are all geographic variants related to *Salmo irideus* which inhabits the streams to points far below Monterey Bay. These fishes migrate from the sea to the streams as steelheads, for spawning purposes. Their progeny live for a time in the fresh water as stream trout, after which they enter the sea, where they rapidly attain large size. We now have facts enough relating to these trout to speak with perfect assurance as to the relationships of the steelheads and rainbows, and the steelheads and cutthroats. The steelheads are stream trout which have gone down to the sea and profited largely therein, to return again after a period of one or more years. We have then cutthroat steelheads and rainbow steelheads. We have steelheads and stream trout, and conservation of the one depends absolutely upon conservation of the other. We burn the candle at both ends when we overfish both the steelheads and stream trout. We are awakening to the fact that we can not both destroy the steelheads and maintain the rainbows. Trout go to sea at ages varying

from one to three or possibly more years. They return from the sea after a year or more of life therein, spawn in the stream, and, if possible, migrate again to the sea. They spawn several times, returning to the sea after each nuptial migration. The extent of their life under the most favorable conditions is not known, but they live for a considerable number of years. They are occasionally taken at sea by salmon fishermen. To the southward the rainbow trout is represented by landlocked forms, the San Gorgonio trout of the San Bernardino region, and the Nelson trout of the San Pedro Martir of Lower California. The latter no doubt reached this far southern point in a past period when colder conditions prevailed, and trout extended over a larger area.

It appears probable that we have, as intimated before, two series of rainbow trouts, the coastal forms and another series which we may term subalpine. The latter are either landlocked or do not enter the sea for some other reason. Among these are our most brilliantly colored forms, the golden trouts, the Kern River and Shasta trouts and the Eagle Lake trout. Under favorable conditions these fishes attain a large size, and no better trout is known. Their age, rate of growth, and many other phases of life history are matters for investigation.

I believe that an understanding and a consideration of the natural geographic distribution of our trout, together with some more definite knowledge of the life history of the various species will be of great value in artificial propagation, and the proper distribution of fry in the streams.

I want to repeat that we have in this state the finest and most beautiful trout in the world—already naturally adapted to the greatest extremes of climate, river, lake and sea conditions. I want to express the opinion, in closing, that we have already made a great mistake in introducing inferior species to cope with our native forms, and any proposition to introduce others, such as the Atlantic salmon, for example, is a tacit admission of our inability to cope with the problem of conservation of our own superior species.

QUAIL SHOOTING IN CALIFORNIA TODAY AND FIFTY YEARS AGO

By Walter R. Welch.

Time: December 1, 1927. *Place:* An old abandoned logging road along the banks of the Gualala River, Mendocino County, California. Two San Francisco sportsmen about to return home after a day's quail shooting. *Equipment:* An auto, and two 16-gauge automatic shotguns.

"Well, Tom, this is the best quail shoot we have ever had. I have nine birds and you have eleven. If we had had a good dog to retrieve all the birds we killed we would have bagged the limit, for I killed at least a dozen birds I could not find."

Let us turn the pages of time back to September, 1872. *Place:* A brush covered pasture near San Gregorio, San Mateo County, California. Two middle-aged men and a boy out for a day's quail shooting. *Equipment:* A saddle horse, three double-barreled muzzle-loading 12-gauge shotguns, and three well-trained bird dogs.

"Jim, how many birds have you and Walt?"

"We got 72. How many have you, Alex?"

"I got 47. With what we killed yesterday that makes about 20 dozen—enough for a shipment. Let's quit."

Alex and James Butchart, who have long ago crossed the Great Divide, were the men mentioned, and the writer was the boy. Well do I remember that day, my first as a "market hunter."

What a difference in the supply of quail in 1872 from that of 1927. The "Butchart boys" began the hunting of quail for the San Francisco markets in Marin County during the Sixties, and about 1870 moved to San Mateo County, locating at San Gregorio.

The Butcharts were brothers, and were real sportsmen of the old Scotch school. While they marketed the game they killed, they did all their shooting on the wing, over well-trained bird dogs. They would spend more time to retrieve a wounded or dead bird than would be required to flush and kill a half dozen birds. Both were splendid wing shots, frequently bagging as many as 60 quail each in a day's shoot. I have seen Jim Butchart kill 27 quail straight, singles and doubles, without losing a bird, the birds being flushed from brush cover.

The "Bissell boys," Englishmen, and twin brothers, were also early-day market hunters for quail in San Mateo County. They did their hunting on the coast side of the county, and also in the vicinity of Woodside, west of Redwood City. The Bissell boys were also good wing shots and did their shooting over dogs.

During the eighties and nineties, Enos Ralston and Thomas Johnson did a great deal of market hunting for quail on the coast side of San Mateo County. These men were also splendid wing shots and did their shooting over dogs.

While those mentioned were the recognized market hunters for quail in San Mateo County during the early days, there were many others who shot and trapped quail for market in that section of the state. Some of those who trapped quail maintained a string, often consisting of as many as fifty traps.

The figure four set was the trap commonly used for trapping quail, much of the trapping being done by boys, and the wives of farmers and ranchers. During the sixties and seventies, and even as late as the early eighties, traps set for quail could be seen all over San Mateo County. All that was required to construct a trap capable of catching quail was a strong, sharp pocket knife with which to cut hazel or other material about one-inch in diameter by four feet in length, which would be placed one upon another in pyramid form, the pieces being made shorter as the trap was built up. When the trap was completed it would be held together by a "binder" across the top, which was fastened by a piece of string to the bottom slat of the trap, thus binding the trap firmly together; the trap being baited with wheat or other grain or seed that might be obtained.

During the sixties, seventies and eighties, Dr. R. O. Tripp, who conducted a general merchandise store at Woodside, San Mateo County, and who made regular weekly trips by team and train between Woodside and San Francisco, handled nearly all of the quail killed by market hunters in that section of the country. Dr. Tripp paid the hunters cash for their quail and resold the birds to the retail game dealers in San Francisco.

The market hunters on the coast side of San Mateo County shipped their quail by Wells, Fargo & Co.'s Express and stage, to game dealers in San Francisco.

The Butchart boys, the Bissell boys, Ralston and Johnson, although referred to and recognized as market hunters, did their hunting more for the sport of shooting than for the money made from the sale of quail.

These hunters used muzzle-loading, 12-gauge shotguns in shooting quail, as did also the majority of quail hunters until about 1885. In 1885, Ralston and Johnson, recognizing the advantage of breech-loading guns over muzzle-loaders, each purchased 14-gauge breech-loading Parker shotguns and 150 brass shells, bought their ammunition in bulk and loaded their own shells.

I have been informed by Mr. Ralston that in quail shooting he loaded his shells with 2½ drams of powder and ¾ of an ounce of shot, and that during the quail shooting season of 1885 he used 310 pounds of number 10 shot and 77 pounds of powder, which indicates that he shot upwards of 6000 times at quail during the open season of 1885. Mr. Ralston also informs me that his best one-day bag of quail was 10 dozen and one bird; that his best double-barrel pot shot was 47 quail, and that his best single-barrel pot shot was 30 quail, and that Mr. Johnson and he would average 6 dozen quail per day in good weather.

William Packard, who had the misfortune to lose his left arm in one early-day sawmill of San Mateo County, was also one of the market hunters for quail in that county during the seventies and eighties. Although having the use of but one arm with which to handle his gun and game, Packard was a successful quail hunter and a splendid wing shot. His best two-barrel bag was 18 quail and his best day's bag was 72 quail.

While many pot shots of from 11 to 30 quail were made during the early days of quail shooting in San Mateo County, some of the record two-barrel pot shots were George Carter, 48; Joseph Frisco, 33; F. Moulton, 32; Alphus Davis, 52; John D. Feliz, 43; Mrs. Frank Bill (*nee* Beckie Palmer) 24, and 46 by the writer.

As the means of transportation developed, the market hunting and trapping of quail spread down the peninsular into Monterey and other southern counties, where, during the late eighties and until about 1901, in the section of country west of Bradley and King City, and in the vicinity of Jolon, Pleyto, Poso, San Ardo, Paso Robles and Santa Margarita, thousands of quail were slaughtered each year by market hunters. In these sections of the state great numbers of quail were destroyed by nets used to trap quail at springs and water holes. The trappers would use a piece of 1-inch mesh net about 15 by 50 feet. The back part of the net was usually buried in dirt, the ends and sides of the net were fastened to willow poles, and a stick about 2 feet in length, to which was fastened about 200 feet of strong string, was used to hold up and trip the trap. A pan filled with water was placed under the net and the trap baited with wheat, chaff or other grain or seed.

As water was scarce in the section of country mentioned, quail in bands consisting of thousands of birds would congregate about the springs and water holes in the vicinity of which the traps were set. When a sufficient number of quail had entered the net, the trapper

who was watching the trap would pull the stick from under the net, and thus cause the net to drop on the birds.

In this manner at times quail to the number of several hundred would be caught by one fall of the net or trap. The trapper would then proceed to kill the birds by using a willow stick with which to hit the birds on the head as they stuck out through the meshes of the net. After the birds had been killed and removed from the net, the net would be reset and baited.

The trapper would then proceed to draw the quail and tie them in bunches of six birds each. The bunches of birds would be hung up in a tree at a distance of about 30 yards, and a shot from a shotgun fired at them, in order to remove evidence that the birds had been trapped.

As a rule the trappers would fill the springs and water holes with brush and so block it that quail would not be able to secure a drink.

FIG. 37. The California valley quail, the finest of California's upland game birds. Photograph by H. C. Bryant, Hayward Game Farm.

The net would then be set, baited and so left for a day in order that the quail would become accustomed to it and enter it; then the trap would be sprung—usually twice in one day—which would result in about cleaning up the flock of quail that frequented that particular locality, which might consist of several hundred birds. The trapper would then move to another location. In this way he would be able to trap and ship several hundred quail twice per week.

As a rule the quail trappers above described worked in pairs, and their outfit usually consisted of a pack horse or mule, a roll of blankets, coffee pot, frying pan, a short-handled shovel, an ax, a shotgun, a piece of 1-inch mesh 15 by 50 feet, a quantity of wheat or other grain for bait, and a large, shallow pan to be filled with water and placed under the net or trap.

The Lambert boys, also brothers, were early-day market hunters in Alameda County and the San Joaquin Valley, as was also Jack Ellis.

During 1891, 1892 and 1893, Jack Ellis did a great deal of market hunting and quail trapping in the San Joaquin Valley, and states that each quail trapper in that section would operate a string of about 100 traps. Pack mules and horses were used to transport supplies and to deliver the birds to shipping points. Mr. Ellis states that sometimes there would be as many as 20 trappers in the vicinity of "Lone Tree Canyon," in the San Joaquin Valley, and that the average catch of quail was about 100 dozen quail per week per man.

The price paid for quail ranged from $0.50 to $1.75 per dozen, depending upon the condition of the birds. In 1885, I saw many quail exposed and offered for sale at grocery stores and butcher shops on Third street, San Francisco, for 50 cents per dozen.

The quail trappers in the San Joaquin Valley, and also in the Monterey County section of the state, seldom did any wing shooting at quail. When quail were shot at in these sections, the shooting was done by "ground sluicing" the birds at springs and water holes, when from 40 to 60 quail would be killed at one shot.

It was not until 1895 that a decrease in the supply of quail became noticeable, and it became apparent that something must be done, and done quickly, to protect quail or the supply would be totally destroyed. Therefore, the Fish and Game Commission, in order to be supplied with data to support the passage of needed legislation, detailed a man to ascertain the number of quail sold in the Los Angeles and San Francisco markets in 1895–1896. The figures secured show that during the open quail-shooting season for 1895–1896, 177,366 quail were sold in the open markets of Los Angeles and San Francisco alone. Of this great number of birds Monterey County furnished 39,831, San Luis Obispo, 25,526; San Bernardino, 12,663; and Los Angeles 11,026. From various other counties in the state were shipped to and sold in the two cities, quail ranging in number from 89 to 9800. These figures do not include quail shipped to and sold in the various other cities and towns within the state, nor quail killed and consumed by the hunters, their families and their friends. The 177,366 quail sold for a total of $15,160.08, or at an average of less than 10 cents apiece.

These figures certainly furnish the present generation and those who are inclined to lay the cause for the present scarcity of quail at the door of predatory birds and animals, with food for thought.

It is quite safe to say that during the eighties and nineties not thousands, but millions of quail were shot, trapped and sold in California, and that had it not been for the enactment of a law in 1901, which fixed a bag limit and prohibited the sale of quail, the supply of quail in this state would have been totally exterminated. The law enacted in 1901 fixed the bag limit at 25 per day and prohibited the sale of quail.

Subsequent to the passage of this law the market hunters resorted to bootleg methods in shipping quail. During the years 1901 to 1909, in order to be able to secure a sufficient number of quail to warrant shipment in a trunk checked as baggage, hunters to the number of eight or ten in the Monterey section of the state would combine in a quail hunt, pool their bag of quail, and in that manner be able to escape game wardens in the field, and transport large numbers of quail to the large cities. Quail were shipped to San Francisco and other large cities in egg cases, butter boxes, rolls of

blankets, green cow hides, suit cases; in boxed demijohns as wine, in coal oil cans as honey, in kegs as butter and salt fish, and in trunks checked or expressed as baggage. Here they sold at from $2.50 to $6 per dozen. In this way, for a number of years despite the activity of game wardens, thousands of quail found their way to the markets of the large cities and were sold in restaurants and hotels, with the result that by 1925 only a pitiful remnant remained of this state's once bountiful supply.

I distinctly recall an afternoon's quail shoot I had in San Mateo County in the fall of 1880, in company with Fred S. Johnson of San Francisco, whose son, Frederick M. Johnson, now resides at San Mateo. On that afternoon Fred and I bagged 98 quail, all killed on the wing, over dogs, in one gulch and from one bevy of birds we had flushed and "stuck" in a ravine bordered by a grain field. We shot 12-gauge muzzle-loading shotguns, loaded with 2½ drams of black powder and ¾ of an ounce of No. 9 shot. I can not recall that on that shoot either of us lost a wounded or dead bird.

In those days a majority of hunters used 12-gauge muzzle-loading shotguns, the usual charge for quail shooting being as given above, during the fall months, with a change to 1 ounce of No. 8 shot during the winter months. As these hunters universally used dogs in hunting quail, very few wounded or dead birds were lost.

It is not predatory birds and animals, or inbreeding, that is responsible for the decrease in the supply of quail in California. The scarcity of quail in this state at this time is due to the usurpation of their food and cover, and to man, who has thoughtlessly and indiscriminately killed and destroyed quail at all seasons of the year in violation of law.

There is no game bird that will respond more quickly to protection than California valley quail, the "Plumed Knight of the Chaparral." To restore the millions of acres of quail habitat that still exist in this state with California's gamest bird, the valley quail, all that is required and is necessary in conjunction with the present law, which prohibits the sale of quail, provides for a daily and weekly bag limit, and protects quail for eleven months of the year, is to *strictly enforce the law*, develop springs and other means to provide the birds with water and feed, and *have set aside numerous small quail sanctuaries and refuges* in all sections of the state.

That small quail sanctuaries or refuges can be made the means of restocking and maintaining the supply of quail in the shot-out quail areas of this state, has been thoroughly demonstrated by Messrs. Edgar A. and John Shaw, of Pescadero, San Mateo County. By maintaining a quail refuge of about 60 acres of land on their 610-acre ranch located near Pescadero, the Shaws during the past 27 years have been able to keep a good supply of quail on their property, and at the same time enjoy quail shooting each year. It is needless to say that the Shaws do no shooting on their 60-acre refuge at any time.

In every county inhabited by valley quail there should be a number of quail sanctuaries or refuges in which shooting of all kinds is *absolutely prohibited* at all times of the year. From these refuges the surrounding country for several miles will become stocked with quail each year, provided that proper water and feed is developed, and the law enforced.

If every county fish and game association or club will interest its members along these lines, and interview farmers and land owners with the view of having them set aside small parts of their holdings as quail sanctuaries and refuges, assist in the development of water and feed for the birds, and *actively support* the efforts being made for the strict enforcement of the laws, within three years, and without the additional expense of importing quail for restocking purposes, every acre of suitable quail cover and habitat in this state can be satisfactorily restocked through natural channels from the nucleus of wild quail already in the fields.

THE RELATION OF PARASITISM TO WILD LIFE CONSERVATION *

By E. C. O'Roke, Parasitologist, Bureau of Research.

While food and water, shelter or cover, and protection from enemies are the factors ordinarily considered in planning for the conservation of wild life, the important but little understood questions of parasitism are beginning to command the attention of conservationists as well as biologists.

A parasite is an animal that lives in or on, and at the expense of another living animal, which is called the host. The term "animal" in the sense that the zoologist uses the word, may mean anything from a one-celled organism to a whale.

Parasites and parasitic diseases of domestic animals have long taken heavy toll from flocks and herds. Wild animals and birds are equally subject to the attacks of parasites, yet parasitism in these forms is rarely brought to the attention of the public.

Science does not know how parasitism originated. In many cases we are helpless to remove parasites from an animal when once they have become established in it. When the life cycle of any parasite is known, however, its control becomes a problem of preventive medicine, in some cases simple and practical, in others exceedingly difficult.

The number of protozoan parasites is legion. Round worms, flukes or trematodes, and tapeworms are also extremely numerous and important.

When we speak of a rabbit's having "blisters" or "boils," we mean that it harbors in its flesh the encysted larval forms of tapeworms. These boils develop in a rabbit only after it has taken in with its food the eggs (embryos) of a tapeworm of the proper species. The source of these tapeworm eggs is the feces of a dog or other carnivore that harbored tapeworms in its intestines. The dog in turn got its tapeworms by eating the flesh of a rabbit that had boils. These various situations with respect to the tapeworm, we call its life cycle.

One of the serious parasites of the range sheep in parts of the Rocky Mountain regions is the fringed tapeworm of the bile ducts. This same form or one that is very much like it may parasitize deer. Its life cycle is unknown.

* A study of the parasites of game is now being undertaken by the Division of Fish and Game and articles on this subject will appear in later issues of this publication.

Fishes, amphibians, reptiles, birds, and mammals are all subject to being parasitised by a variety of forms of flukes and tapeworms.

One characteristic of the flukes is that nearly all of them live at some stage of their existence in the body of a snail or other mollusk, where they undergo part of their development. The fluke parasites of waterfowl are therefore intimately associated with the kinds of snails that live in the marshes where they feed.

Of particular interest is the fact that an introduced animal for instance may bring in parasites that might prove to be fatal to a native species. Similarly, a native species might transmit its parasites to an introduced form with fatal results.

Parasites may exist in animals for generation after generation with seemingly little effect, then suddenly they may flare up in enormous numbers, and be so virulent as to practically annihilate their hosts.

At times in some of the lakes in the northern lake states, the flesh of the bullheads is simply plastered with the yellow cysts of parasitic trematode worms. The combination of factors which brings about this condition is unknown, but whatever its explanation, the wormy fish have a serious effect upon commercial fishing activities in the infested areas.

Within the field of parasitism are many practical problems of present day biology that challenge the attention of all who would practice "Conservation of wild life through education."

VARIOUS CONDITIONS REGULATING BIRD POPULATION AND MIGRATION

By D. D. McLean.

In certain bird-infested localities, where the responsibility for much damage to fruit and other crops has been placed against birds, it has been a leading question among farmers and orchardists as to just what attracts them to the area besides the food. The question becomes puzzling when other localities with the same fruits and crops are unharmed by them.

Several factors seem to govern the movements and feeding habits of the various species of birds, both those which are destructive and those which are likewise known as beneficial.

In order to help distinguish between the various types of country, both faunally and geographically, the terrain has been divided by zoologists and botanists into so-called life zones. We find that these zones include the following: Tropical, Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian and Alpine-Arctic. The following are a few points to be used in determining these zones. The Tropical is characterized by a warm, moist climate; heavy plant growth, often known as jungle. The Lower Sonoran is characterized by deserts, thorny trees and shrubs, cactus, hot winds and dry atmosphere. Quite often there is a lack of trees and shrubs of any kind; the Upper Sonoran is the foothill zone with many deciduous trees and shrubs. There is little barren ground in this zone as a rule. The Transition is that type of country where one finds both deciduous and coniferous trees present in nearly equal numbers. The northwestern redwood

belt is generally considered Transition, but there is a close relationship between it and the Tropical and Canadian life zones. In the Canadian zone, one will find the heavy stands of timber, mainly of coniferous varieties, with only a few of the hardier species of deciduous trees present. The Hudsonian zone includes forests, often dwarfed, barren ridges, granite domes and peaks, wet meadows and glacial lakes. The Alpine-Arctic begins at the upper edge of the Hudsonian, or timber line, and continues on up to the tops of the highest peaks and into the polar regions.

This classification will be found usable whether one is climbing from low country up to the mountains or traveling north into the Arctic regions.

In certain sections of the state we find sheltered areas where the winds are broken by foothills, groves of trees or other natural barriers. Flocks or groups of birds will seek these sheltered covers and there spend the winter. From these protected places the birds scatter out over the adjacent fields and orchards to feed, returning to rest. Wherever orchards, vineyards and other crops are located in or near these foothill coves the damage done by birds is often considerable. Those products which are grown out into the larger valleys are often unharmed, because there is a lack of necessary cover for protection.

The sheltered Upper Sonoran section of the eastern San Joaquin Valley, in which is located Visalia, Lindsay, Exeter, Strathmore, Lemon Cove, Porterville, Terra Bella and Tulare, is overrun in winter with various birds such as the linnet, golden-crowned and gambel sparrows. This area is comprised of open land with but little prevailing wind and many foothill canyons which are sheltered from storms and the temperature is seldom low. There is a quantity of natural food in the form of turkey mullein, water grass and wild portulaca. Formerly, there was probably an abundance of food out in the open country where the deciduous fruit section is today. This, however, is now lacking, due to cultivation; hence, since the birds by instinct come back to this section each winter, they have by necessity turned to the next best food, which has been chosen as the buds of several deciduous fruit trees.

On the western side of the San Joaquin Valley from Coalinga north there is a belt of country where the winds are strong and water is scarce. Very few birds are present in this district, although weeds are fairly plentiful and there are areas of low brush which would make fairly good cover. It seems that the scarcity of water and the strong winds tend to keep the birds from spending their winter months there.

Deciduous orchards and vineyards which are in close proximity to citrus groves are particularly in danger because of the protection afforded the birds from the elements and enemies by the dense foliage.

Telephone, electric, telegraph and fence wires are attractive perches that are taken advantage of by many species. These wires should always be taken into consideration before such drastic measures as poisoning and shooting are undertaken. Large trees offer excellent lookout stations for wary species. Such birds usually perch and scan the nearby territory before dropping down to feed. Clumps and tangles of willows, berry vines, rosebushes, hedges, arbors, tangled masses of wire, weed patches and similar situations are all harbors for many species of brush and ground inhabiting birds.

It will be found, after the breeding season, that many species of birds begin to congregate into flocks, while others go individually into suitable places to spend the colder months of fall or winter. Resident species remain here all winter while certain migrant species stay until they depart for the south later in the fall.

In migration, various geographical conditions enter into the routing of flight lanes to and from their northern breeding grounds. Deserts, mountain ranges, north and south valleys, forested areas, lakes, streams, headlands, bays, straits, oceans and mountain passes all seem to regulate the flight. Of course there are always some exceptions. Some of these conditions attract some species, while others deflect their flight to one side or the other. Some birds take one route northward in the spring and return south in the fall by an entirely different one. In some instances these routes are a thousand miles or more apart.

Some migrating birds do not seem to be inconvenienced in the least by natural barriers. This appears to be true of cranes, pelicans, geese, hawks, swifts and other species with exceptional powers of flight. Cranes, geese and pelicans soar to great heights, then take the familiar V-shaped formation and pass over mountains, deserts, lakes and canyons, pausing now and then to once more gain altitude by soaring.

When we speak of migration, we do not necessarily mean the bird flies in a direct north and south route, for that has been proved false. Ducks have been banded one winter in the central United States and have presumably gone north for the summer and the following winter were taken in California. Other species have a migration movement known as altitudinal; that is, they move up the mountain slopes in summer and down in winter. The mountain quail is an excellent example of this type of migration.

During the nesting season most birds pick out their particular niche and are only found there. There are occasional exceptions to the rule, but on the whole, for example, if the bird prefers riparian willow thickets, that will be where one will find the greater majority of that species.

The Ross snow goose is a good example of a species which winters in one small area. Practically all of the Ross snow geese winter in the interior valleys of California and formerly in Los Angeles County. The breeding range of the species is unknown but is presumably north of the mouth of the Mackenzie River in the Arctic regions.

Some birds are very locally distributed, even in the breeding season, that is, in one locality the species will be numerous, while in nearby territory of the same general character it will be practically absent. There is presumably some reason, not always evident to man, but of importance to the bird that causes it to be either present in numbers or absent. Still other species have become localized by the inroads of their enemies, such as man. In this group, the California condor, yellow-billed magpie and white-tailed kite are good examples. Some, which were formerly only distributed locally, have now become generally numerous due to the spread of cultivation and reclamation. Competition with man's interests become so keen in other instances that a bird is finally wiped from the face of the earth, becoming extinct. Examples of this are the great auk, passenger pigeon, Labrador duck and Eskimo curlew. Others apparently due to follow the above are:

trumpeter swan, whooping crane, white-tailed kite, California condor, heath hen and clapper rail.

If a bird's natural breeding ground is destroyed, it will, as a rule, disappear from that area. As the destruction continues and finally becomes complete over its whole breeding range the bird will eventually disappear as a member of the fauna. So far none of our American birds have met this fate but the heath hen, prairie chicken, swallow-tailed kite, clapper rail, whooping crane and trumpeter swan are doomed.

Water governs the bird population in many cases. This is especially true in the smaller species found in the more arid sections. They do not generally fly a great distance in order to secure water, consequently when available water is covered over or piped, they must seek new fields.

Prevailing winds are shunned by many species that congregate in sheltered mouths of foothill canyons. A noticeable exception to this is the horned lark. This bird seems to prefer the cold, bleak, wind-swept plains, feeding on open ground where even the grass and weeds are stunted.

It is interesting to note the attitude of various migratory birds toward storms and clouds. Over certain parts of the Sierra Nevada mountains, sandhill and little brown cranes pass regularly to and from their northern breeding grounds. Oftentimes in their spring migration they have been observed to come up from the San Joaquin Valley and take a diagonal course across the mountains only to encounter a storm or cloud bank in their ascent up the western slope. Their first endeavor is to fly over it by soaring to great heights. This failing, they will try to fly through it, but seldom do. After much wheeling and calling they generally coast back down the slope to the valley again. Geese, however, will usually fly through a storm or over it with little unnecessary demonstration. Fog, however, will befuddle a flock of geese as well as cranes and often break it up entirely, many becoming lost.

I have seen an entire flock of geese return toward the lowlands when a golden eagle made a swoop into the group. Cranes, however, show little concern other than the increased volume of calling, over an eagle's onslaught, even though the bird may have gone through the entire flock and scattered it temporarily. They soon come together again and continue on their way. This is an excellent example of the difference in temperament between two migratory species that follow similar routes in migration.

Many species of birds abound in forested areas, never wandering out into the open country, while others may be found present in both types of country. Even then there is generally a preference. Hawks usually nest in forested country but do a considerable part of their hunting in the open.

One can see the way varying natural and unnatural conditions regulate the movements and numbers of birds in various sections, not to mention food as an attraction. At no time can one be certain that a bird is going to be common one year, in a certain locality, simply because it was common the year previous. Any one, or a combination of the many factors, may change their range, while nearby they may be numerous.

The numbers of ducks and geese are governed on their winter range by food and water conditions and the amount of shooting done, to a noticeable extent. Heavy shooting causes the birds to rise and if the shooting is continued, they will gradually shun the area entirely, often apparently leaving for distant parts. Even when there is plenty of food, the birds will take their departure as soon as the season opens.

A good example of what a little protection will do was noted in the fall of 1927 at Los Banos. A few hundred acres of Miller and Lux holdings were under observation.

No hunting was done except on Sunday morning. The birds, both ducks and geese, were quick to take advantage of this and congregated there by the thousands. It seemed like half of the birds in the San Joaquin Valley were located on that small tract. This shows what could be done in the line of conserving a breeding stock of the various species.

The summer visitants do not seem to be affected by varying conditions as much as migrants and winter visitants. Resident birds are quick to take advantage of any opportunity offered them in obtaining food, and protection from enemies and severe weather.

High winds are almost sure to cause a movement among birds, especially the ducks, geese, cranes and shorebirds. Most of their movements are performed at night so we know little of what actually takes place. We do know that an influx of winter birds can take place in a few hours.

There are three general migration routes for ducks and geese into California from their northern breeding grounds. One from the north along the coast usually off shore, one down the great valleys from Oregon and one from the Nevada sinks across the Sierra Nevada mountains into the San Joaquin Valley.

Through reclamation, so much of the original ground used by birds at various seasons has been changed that the formerly common species are no longer present. Is it any wonder that they change their flight lanes and are seldom seen again?

It is high time something should be done in an effort to prepare a winter range for such birds as ducks, geese and shorebirds in California. One should be in the Sacramento Valley and one in the southern San Joaquin. This would be preferable in order to take care of the birds coming in on the two distinct migration routes to the great valleys. These are the birds that reclamation is ousting from the state. On such a range, food should be plentiful at all seasons. None except the trained naturalist or wardens should be allowed on the premises and absolutely no hunting, farming, building or reclamation. There should be a generous planting of food plants. There should be open water, marsh, dry ground, mud holes and sloughs.

We are certainly devoid of such refuges in the state but not due to the scarcity of suitable space, but to poor foresight on the part of those who should be most interested in the conservation of our natural resources.

In writing this article, I have endeavored to show the numerous factors concerned in the distribution and migration of birds. Also the necessity of careful study, by experienced men, of the life zones, food conditions, sheltered areas, prevailing winds, natural barriers,

flight lanes, temperature, water conditions, storm areas, fog belts, forests, plains, reclamation, shooting, predatory animals and like conditions before refuges are established or similar projects undertaken. The same study is necessary in order to properly control the damage done to agricultural interests by birds. Until such studies are performed it is folly to blindly place a refuge or undertake the control of injurious birds.

REPORT OF THE COMMITTEE ON SPECIES DESTRUCTIVE TO GAME

(Adopted at the Fourteenth National Game Conference.)

The Committee is faced with a problem that for a long period has been perplexing to sportsmen and, at times, has received the most radical and unwarranted treatment. In the absence of basic knowledge, prejudice has had full sway and has led unthinking people to commit deeds harmful, and when carried to extreme, disastrous to game conservation. In taking up this problem, the committee has done so with an open mind and with the determination to treat each species under suspicion justly and equitably, as human beings are treated in courts of justice in accordance with law.

ALL ANIMALS PREDATORY

It is doubtful whether there are many forms of vertebrate life that will not devour or destroy the eggs of birds if they have the opportunity. It is only through eternal vigilance on the part of parent birds, and their ability to place their nests where they are hard to find, that many young are brought to maturity. If it is true, as we believe it is, that all animals are more or less predaceous, it then would seem to be our duty to check one against another and for the good of the whole to encourage those that do the least harm.

MARSH HAWK EATS FEW QUAIL

In carrying on quail investigations in Georgia, Mr. Stoddard found that the marsh hawk, in more than a thousand meals, ate four quails only, but fully a thousand cotton rats, which rodent in turn was found to have taken 7 per cent of all quail eggs destroyed. To destroy this hawk indiscriminately, except locally where a few individuals are doing harm, is one of the most deplorable methods taken in an attempt to conserve game.

OWE MUCH TO ORNITHOLOGISTS

Since we owe to ornithologists the greater part of our knowledge relative to the food and breeding habits of birds, facts touching on their migration and distribution, and the control of diseases and parasites affecting them, it is difficult for your Committee to understand why some game commissions and sportsmen are prejudiced against ornithologists. If for any reason ornithologists should stop collecting and studying birds, sportsmen would be one of the greatest losers. What possible harm can be done in following this research work, when esti-

mates show that ornithologists kill annually not over 20,000 specimens out of approximately 1000 species and subspecies, while sportsmen in one-fourth of that time kill 20,000,000 birds included in not more than 100 species? Some ornithologists and sportsmen may kill excessively, but why condemn the whole?

AS TO THE KINGFISHER

There are some who consider the kingfisher a direct menace to trout culture. If individuals congregate about trout hatchery ponds and commit depredations they can be easily controlled. In some states even where the kingfisher has always been rare, it is almost impossible for well-equipped fish commissions to keep the streams supplied with fish to satisfy the ardent fishermen. Since kingfishers are no more abundant now than they were when the streams teemed with trout, it would be well for us to be fair with ourselves and to acknowledge this truth.

While many fishermen are complaining of mergansers as fish eaters, what should be said of a large black bass, which we recently have learned fed on young ducklings.

SPARE THE SEA LION

Alleging that the sea lion destroys salmon, commercial fishermen want to exterminate this marine mammal, when in truth it feeds principally on squids and fish of little commercial value. Almost criminal destruction of salmon by commercial canneries must be defended, and the scarcity of the fish explained by accusing the sea lion, which apparently has no sponsor in court.

The thoughtless or selfish gunner who has no consideration for breeding stock will exterminate a covey of quail and then try to make himself believe that the mouse-eating hawk sitting in the top of a dead tree in an adjoining field, is the real culprit.

SONG BIRDS EAT FRUIT AND GRAIN

The food of many of our favorite song birds includes at least 10 per cent that is of value to man, such as fruit, grain and garden produce, and many of our game birds are even worse offenders.

In approaching our problem, therefore, it would seem just and equitable for us to give little thought to those species that do not destroy more than a potential 10 per cent, except under strictly local conditions.

QUESTION IS REGIONAL ONE

Species must also be considered regionally. For example, the grape growers of California recognize that the quail is one of the most destructive species, and some would like to have these birds exterminated in their vineyards. New Hampshire paid $14,000 to those who have suffered from grouse depredations in their orchards. The great horned owl is destructive to game and poultry in the east, but in the far western states is most beneficial as a destroyer of such pests as jackrabbits, cottontails and pocket gophers.

RODENTS VERY DESTRUCTIVE

Economic biologists have learned that rodents often are naturally, or seasonally, very destructive to game and poultry. The common wharf rat is one of the best examples of a carnivorous animal. In localities where the rat's natural enemies have been killed or driven away, game birds have little chance to save their eggs or young. The alien house cat, through the mistaken kindness of those who dislike to kill kittens, has taken possession of many wild areas and in the more settled localities probably does more damage to wild game and song birds than all their other natural enemies combined.

SOME HAWKS ALTOGETHER BAD

Although the Cooper and sharp-shinned hawks have a tendency to keep the fruit and grain-eating birds from becoming too numerous, when given the opportunity they destroy game birds and poultry, and consequently must be controlled.

The goshawk, a bird that periodically enters the United States when food is scarce in Canada, is one of the most notorious species destructive to game and has little to be said in its favor.

SNOWY OWL NOT CONDEMNED

Late migrations of the snowy owl brought hundreds of individuals from the north last winter, and, from examination of stomachs, these birds were found to have fed largely on the house rats. The ducks that it was supposed to have fed on had been disabled or killed by the oil menace, which is so destructive to all forms of ocean life and which is one of the serious problems to be considered by sportsmen if waterfowl and shellfish are to be preserved.

OTHER HAWKS AND OWLS

Taking the country as a whole, the duck hawk and the prairie falcon are the only other bird-eating hawks to be considered. They, however, are nowhere abundant and do not confine themselves strictly to waterfowl and upland game birds. The food of the larger, slow-flying hawks and owls, including the red-shouldered, broad-winged, rough-legged, swainson and red-tailed hawks, and the barred, long-eared, short-eared and barn owls, consists mainly of rodents and insects, which in their turn are injurious to agricultural products and game.

VALUE OF FUR BEARERS

In our effort to control we must remember that many of the predatory animals that are valuable fur bearers are rigidly protected by closed seasons in some states, and that the sale of their skins makes up a considerable part of the $65,000,000 annually paid for native raw furs. The bear is a game animal and should be killed out of season only when destructive to live stock. The same may be said of fur bearers that support a valuable industry and at times are feeding upon rodents destructive to game.

GROUND SQUIRRELS AND COTTON RATS

A member of the Committee has been informed by the late Mr. Samuel Evans, of the Evans Game Farm in Illinois, that ground squirrels destroy more young pheasants there up to the time they are a week old than do weasels, minks and all other predaceous species. As above stated, Mr. Stoddard found that the cotton rat took 15 per cent of all the quail eggs that were destroyed by natural enemies.

The Chairman of this Committee has seen probably fifty weasels carrying mice or young squirrels, and in no instance a game bird. The marten, when at all abundant, keeps under control the red squirrel, a great destroyer of eggs and young birds.

A LOCAL QUESTION

In recommending control of those animals that are truly game destroyers, locality must first be considered. In and about game refuges or fish hatcheries, those that are naturally or by education or environment destructive to game should be carefully considered and dealt with as occasion demands. It is felt that the fur trapper can be trusted to keep the general mass of predatory fur animals under control, so that game breeders have to cope only with individuals that from time to time become troublesome.

The matter of control of enemies of game must be looked at from every angle by game breeders and sportsmen, since other important agencies enter into the problem.

MAKE HASTE SLOWLY

We must go slowly in an attempt to kill those animals of service to agriculture or valuable as fur bearers and never destroy other than the individual attacking game. In this way we secure the culprit, save the lives of those valuable to agriculture and as fur bearers, and thus hold the respect and cooperative spirit of the farmers and those interested in fur-bearing animals.

IMPRACTICAL TO LIST SPECIES

Conditions and circumstances vary so widely that your Committee finds it impossible and also undesirable to present a list of species which should be classed as destructive or to recommend definite measures of destruction. It firmly believes, however, in two fundamental principles which should govern our actions in the control of species which either generally or locally may be destructive:

First—We are opposed to bounties.

Second—We believe in local control under proper legal supervision.

(Signed)

A. K. Fisher, Chairman, Alden H. Hadley,
A. G. MacVicar, Frank M. Chapman,
John C. Phillips, Frederic C. Walcott,

—*American Game,* January, 1928.

CALIFORNIA FISH AND GAME

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May 14, 1928.

HIGH LIGHTS OF THE CONVENTION

Deputies from all parts of the state assembled in San Francisco, February 28, 29 and March 1 for the third annual convention of employees of the Division of Fish and Game. The purpose of the convention was to secure better cooperation within the Division and to give the deputies a better understanding of the different fields of work and to enable the men to meet and to exchange ideas.

The convention was formally opened on the afternoon of Tuesday, February 28 by a welcoming address given by President I. Zellerbach. He reviewed the accomplishments of the Division stressing increased license, plenary powers, holding tanks, new hatcheries, fish distribution, radio, new moving pictures, research on disease, and screens and ladders. This was followed by a few words from Commissioner George Clarkson. Mr. Earl Kauffman, representing the sportsmen of the state, requested in their behalf, the cooperation of deputy and sportsman. Mr. B. D. Marx Greene, former executive officer, then spoke to the deputies asking them to give to Mr. Bennett, the new executive, the same willing help that he received while in office.

Mr. E. D. Bennett, executive officer, then gave a very straightforward declaration of the policy of the Division. His pleasing discussion and his feeling toward his new position won for him the confidence of all.

Mr. F. H. Vore, director of the bureau of Public Relations, explained how a deputy could use newspaper publicity to good advantage.

The convention was very fortunate in having present Dr. H. C. Oberholser, chief biologist of the U. S. Bureau of Biological Survey, who explained the work of the survey in taking bird censuses, a nation-wide project. Mr. Oberholser's address is being reviewed at greater length in this issue.

The question of the advisability of the deputies wearing uniforms was discussed. It is now the consensus of opinion that all deputies should wear uniforms, particularly when appearing in court, and it will soon be obligatory that they do so. The color decided upon is a forest green.

Mr. Walter Welch, captain in charge of volunteer wardens, spoke briefly on the work of those under his direction and requested that cooperation be given this group of men by the deputies.

Mr. Horace M. Albright, superintendent of Yellowstone National Park and assistant director of the National Park Service, gave an address, illustrated with lantern slides and motion pictures on, "Game Conditions in Yellowstone National Park."

A highly entertaining feature scheduled for late in the afternoon was the exhibition of disarming, given by the San Francisco police athletic team. This was preceded by a very interesting talk given by Captain Duncan Matheson, of the San Francisco Police Department.

The annual banquet was held the evening of the 28th at the St. Francis Hotel. The Division was honored by having present Governor C. C. Young. The Governor voiced his appreciation of the excellent work being done for conservation by the Division and sssured all those present that he was heart and soul for the program as outlined by the Division. The rousing talk by the Governor made the men feel that they were fellow workers in the business enterprises of the state.

Mr. A. R. Heron, head of the Department of Finance, was also a guest. He assured the Division employees of the support of his department in their efforts to preserve the state's natural resources. Motion pictures taken by Jay Bruce, state lion hunter, and other educational films terminated the evening's entertainment.

The program was opened the following day, February 29, by a talk on the subject of trout given by J. O. Snyder of Stanford University. This address is also reproduced in this number.

Dr. H. C. Bryant, director of the Bureau of Education reviewed briefly the more interesting books, which are available in the library of the Division.

A clear explanation of the intent and uses of the radio together with a demonstration of the instruments was made by H. J. Breuer.

The work of surveying and posting refuges, made possible by the increased license fee and deer tag license money, was explained by J. S. Hunter, assistant executive officer. Mr. Hunter's address is found elsewhere in this magazine together with the very interesting and informative talk of Dr. K. F. Meyer on "Facts You Should Know About Animal Diseases."

The captains were then given an opportunity to meet and to discuss with their deputies the work being carried on in their respective counties.

On the afternoon of the 29th, an innovation was introduced into the convention in the form of a "short course of instruction." Thirteen able and competent instructors gave half-hour lectures on interesting, pertinent subjects of value to the deputy in his work. The deputy was granted the privilege of attending the lecture in which he was most interested. The lecture on "First Aid" given by Dr. M. J. Seid was required of all.

The following morning the men assembled at the Presidio for a pistol shoot. A perpetual trophy, a silver cup, presented by President Zellerbach, was the reward offered. Deputy Taylor London, of Requa, one of the newest and youngest employees, carried off all honors in this event with a score of 96 out of a possible 100.

The program for the closing afternoon began with a talk on "Evidence in Game Cases—Relation to the Court" given by Eugene D. Bennett.

Joseph Dixon, economic mammalogist of the Museum of Vertebrate Zoology, University of California, spoke on a much discussed subject, "The Conservation of Predatory Animals." In this talk, Mr. Dixon paid a very fine tribute to the work of Jay Bruce, state lion hunter.

This address was followed by the answering of questions which had been placed in a "Question Box." The majority of the questions were on the interpretation of the fish and game laws. After discussion the meeting adjourned and the convention closed.

The Division of Fish and Game wishes to take this opportunity to thank the Extension Division of the University of California for the use of the University Extension Building, in which all meeting were held; also to extend its thanks to Dr. Oberholser, Mr. Albright, Captain Duncan Matheson, the San Francisco police athletic team, Dr. M. J. Seid and Mr. Dixon for their presence and assistance in making the third annual convention of this Division a success.

3—58645

The following resolution was adopted:

Whereas, E. W. Hunt has been with the Fish and Game Commission, under the able leadership of our old war horse W. H. Shebley, in the Fish Culture Department, for the past forty years, without practically losing a day; and

Whereas, We all fully appreciate the invaluable services rendered by him for and on behalf of the Fish and Game Commission; and

Whereas, He is now and has been seriously ill and unable to attend to his duties in the care of the little fishes as field superintendent; now, therefore, be it

Resolved, That we here in this convention assembled all extend to him our profoundest sympathy with the strongest hope for his speedy recovery; as well as an early return to his work among us; and be it further

Resolved, That this resolution be spread upon the minutes of this convention, and that a copy thereof be sent to E. W. Hunt.

From his associates, deputies and assistants of the Fish and Game Commission at their Third Annual Convention at the University Extension Building, San Francisco, California, March 1, 1928.

GAME FARM WILL EXPERIMENT WITH NEW BIRDS

A state game farm should not only rear and plant pheasants within the state but it should determine experimentally what other game birds are suitable for introduction into those parts of California where native game has disappeared. Within the past few months, the State Game Farm at Yountville has received a shipment of three different kinds of tinamous from South America and a shipment of bamboo partridges from the Orient. The tinamou is the most notable upland game bird of South America and undoubtedly it is of high value for food, but whether the species is attractive as a mark for the gunner and whether it can be successfully acclimated in the cultivated sections of the state is yet to be determined. The test now being made is to discover whether or not these foreign game birds can be successfully reared in numbers on a game farm.

REFLOODING OF KLAMATH LAKE CONSIDERED IMPRACTICABLE

Apparently protests regarding the drainage of lower Klamath Lake came too late to be effective. Ten years after the lake was drained, sufficient interest in a reflooding program lead to the raising of a sum of money for a survey of the situation. After a thorough study by a competent engineer, the difficulties in the way of reflooding appear insurmountable. More than 80 per cent of the water of the Klamath River has been appropriated, leaving insufficient for the reflooding of the lake. The Bureau of Biological Survey has announced the abandonment of the reflooding project. At the same time

this government bureau states that a federal refuge will continue to be maintained at lower Klamath Lake, where there will always be found some areas of water.

With the abandonment of the Klamath Lake project, attention has been centered on restoration work on the Bear River marshes, where the state of Utah has already diked and made into a public shooting grounds some 30,000 acres of marshland. There is additional area which can be suitably reclaimed to furnish a refuge for ducks. The state of Utah by legislation consented to the establishment of a federal project which will cover more than 100 square miles of fresh water marshland. A bill now before Congress is to provide funds for this development. This area is both valuable as a breeding ground and as important concentration area for ducks during their migration. The project also will help to alleviate serious inroads due to "duck disease."

GAME WARDENS' DUTIES MULTIFARIOUS

In times past, the average picture which came to the mind at the mention of "game warden" was some political favorite who spent his time talking in the corner grocery or in a near-by saloon. Nowadays a California game warden is a respected man of the community, always on hand to run down a violator and equipped with underground channels of securing suitable information. But this is not all. He is expected to be a naturalist and public speaker and able to handle an educational campaign. To many, efficiency as a police officer and as a lawyer and prosecutor come more easily than the role as scientist and educator.

The standard has continually been raised; unfortunately, not so the salaries.

JOHNSON BILL WOULD PROVIDE WILDFOWL REFUGES

At the request of sportsmen, Senator Johnson has introduced into congress, Senate Bill No. 2718. This bill shows the genuine effort being put forth to secure adequate feeding and resting grounds for waterfowl in California. It authorizes the Secretary of Agriculture to acquire by purchase, gift or lease such areas of land, or land and water not used for agricultural purposes, as may be determined suitable for use as a migratory bird refuge. A sum of $1,000,000, or so much thereof as may be necessary, is asked to carry out the provisions of the act.

KLAMATH RIVER SALMON EPIDEMIC

Great numbers of king salmon died on the Klamath River during the month of November, 1927. In every respect, conditions were like those during the epidemic of 1922. The mature fish were attacked, particularly the females, whereas the younger fish appeared to be resistant. Dr. George A. Coleman, biologist, after an investigation, called attention to the following facts:

1. The dead fish were in especially fine physical condition. However, the gills were found covered with a heavy coating of blue-green algae and diatoms. This apparently prevented free circulation.

2. The water was found heavily charged with gases. An odor accompanied the vegetable matter in the water.

3. Analysis showed an unbalanced condition in the water: a total lack of zooplankton and a superabundance of blue-green algae which indicate a condition of stagnation and decay of vegetable matter.

4. The presence of deleterious gases in the water and the superabundance of algae and diatoms sufficient to produce asphyxiation is the probable explanation of the epidemic.

CROWDING AND THE BIRTHRATE

That there is a possibility of basing the toll taken by the hunter on known facts regarding birth rate and death rate is attested by recent findings of biologists. In a recent number of *The Quarterly Review of Biology*, Dr. Raymond Pearl discusses growth of populations. He points out that experimental study is bringing to light broad facts regarding general biology of population growth. Organisms of the most diverse kinds ranging from bacteria and yeast to man are found to follow in their growth a particular type of mathematical curve. The two more interesting laws supported by investigations are:

1. Death rate slowly increases with density of population until a certain point is reached and then increases rapidly.

2. On the other hand, birth rate increases markedly at first with increased population but later is but slightly affected.

With these laws before us, light can be shed on results to be expected when in planting trout we crowd the population into narrow limits. Under such circumstances, provided a certain density of population is reached, the death rate increases enormously.

Another point of view: When we continually take a certain toll of quail on an area, we automatically increase the birth rate. In other words, nature has so arranged matters that greater toll of adult individuals means increased birth rate. Experiment has shown that such an in-

crease need not await several years time, but appears rather quickly.

Admittedly such a discussion is rather technical, but the greatest advances in the future are going to be along lines which have taken into consideration basic biologic laws.

THE ANNUAL KILL OF DUCKS

The sportsmen's column in a metropolitan newspaper has recently published the number of ducks killed by various sportsmen during the open season. It is suggested that 400 birds during the season is a high average for a member of a gun club. Since we have yet to have a means of taking the census of the annual kill of ducks, every opportunity of securing a basis for such a computation is utilized. If we knew what the average kill of the gun club man is and the total number of members in the state, there would be a means of estimating the numbers of ducks killed on the grounds. Then if a similar computation could be made for the kill of the independent hunter, some basis of computation would be at hand. As it is the old guess of 1,000,000 ducks per year must hold. Meantime, it is worth while looking forward to the day when a census similar to that provided by the new deer law will be available.

MUSEUMS HELP IN NATURE EDUCATION

Originally museums were static institutions. Exhibits covered with dust awaited visitors and few labels there were to help in understanding the displays. A modern museum not only provides proper labels but furnishes a lecturer whose duty it is to take groups of school children through the museum. The more worthwhile exhibits are thus pointed out and properly described. Yet another departure is to be found in the field trips which are offered by certain museums. The San Diego Museum of Natural History reports that during 1927 thirty-two trips were taken to various localities, sixteen being made on foot, fourteen in chartered buses and two in chartered boats. The object of these field excursions was to furnish opportunity for a first-hand study of natural history. That this type of educational work is appreciated is evident from the splendid attendance—2810, an average of nearly 100 per trip. Educational work of this kind is fast building up an appreciation of natural resources which will mean much in future conservation work.

FIG. 38. Patients at the receiving pens, "duck hospital," near Buena Vista Lake, February 11, 1928. Photograph by Roy Ludlum.

BIRD BANDING ON LAKE MERRITT

The U. S. Biological Survey, through the agency of E. W. Ehmann, A. D. Trempe and H. P. Gray, trapped and banded between 1100 and 1200 ducks on Lake Merritt, Oakland, California. This is the largest number ever banded at one time. Birds banded at Lake Merritt have been taken later in Alaska in the north, and San Diego in the south.

SALVAGING DUCKS ON BUENA VISTA LAKE

After being dry for several years, some 23,000 acres were overflowed in Buena

Vista Lake during the spring of 1927. This was the only large body of open water in the southern part of the San Joaquin Valley and apparently offered ideal conditions for waterfowl. Conservative estimates indicate that some 80,000 ducks were killed during the open season. A census taken about a week after the season closed indicated that, at that time, approximately 125,000 ducks were on the lake.

However, although conditions appeared to be ideal for ducks, "duck sickness" made its appearance early last fall. The cause of the disease has not been discovered. Investigations have shown that it is not the so-called "alkali poisoning." So far no communicable organism has been found to be the causative factor.

Through the courtesy of the Western Water Company, pens and other facilities were furnished on the property of this company near the lake. Sportsmen from local organizations at Bakersfield and Taft cooperated with our deputies, and some 700 ducks that were unable to fly, including sick and crippled birds, were collected. Many of the birds so collected were in a critical condition. When first placed in the pens, some would lie prostrate for several hours. Some of these died, but most of them began to drink and eat within twenty-four to forty-eight hours. After the birds began to drink and eat, recovery was usually rapid and it became necessary to separate the birds and segregate them in pens containing others in the varying stages of recovery to prevent

FIG. 39. Evidence that treatment was effective. Recovered patients at the "duck hospital" near Buena Vista Lake, February 11, 1928. Photograph by Roy Ludlum.

The Division of Fish and Game, in cooperation with the Hooper Foundation for Medical Research, is now making preparations for a thorough study of the disease and it is believed that considerable progress will be made during the coming year.

In the case of Buena Vista Lake, as in certain other instances, it was found that a large percentage of sick birds would recover when removed from the affected area and placed on different water and feed. As a considerable number of sick and crippled ducks were on the lake after the close of the season, this Division undertook to establish a "duck hospital" and salvage as many as possible.

the stronger birds from injuring the weaker ones. As soon as the birds were sufficiently recovered, they were banded and liberated. During the latter part of February about 500 were released. The ducks remaining in the pens will be liberated as soon as they recover.

The program at Buena Vista Lake has already effected the recovery of at least 500 ducks and will add this much to the numbers that will make the flight to the northern breeding grounds. In addition, it has made possible the banding of a large number of birds, the returns from which will add materially to our information on migrations and lines of flight.

Work at Buena Vista Lake will be continued. The sportsmen of the state can be assured that the Division of Fish and Game will continue its investigations to the end that all possible information regarding the disease of ducks will be secured and that the mortality will be reduced to the minimum.

A REMARKABLE DISPLAY OF WILDFOWL

In many ways California is particularly suited for experiments in breeding our kinds of birds. Persons who follow aviculture as a hobby can doubtless furnish a very large list of birds which have never been successfully bred elsewhere.

FIG. 40. A Lake Almanor rainbow trout, a limit in weight. Photograph by Perc Meakin, August, 1927.

Two in California have recently turned their attention to worthwhile experimental work along the lines of game breeding. Mr. F. E. Booth, a well known business man of San Francisco, has established a large game farm near Woodland, in the Sacramento Valley, and is specializing on various kinds of upland game birds. Mr. J. V. DeLaveaga, also of San Francisco, has interested himself in the propagation of wildfowl, not for profit but for his own pleasure. On his estate in San Mateo he now has fifty-eight different varieties of ducks and more than twenty different varieties of geese. If this collection is not the finest to be found anywhere in the world, it certainly takes second place! Among rarities are the Paradise shelldrake, the Abyssinian yellow-bill, Baer's pochard and the Magellan and Egyptian goose.

Excellent conditions for breeding having been furnished, Mr. DeLaveaga can boast of splendid success. Even some of the rarities noted above have successfully reared their young. Although the rearing of wildfowl is largely a hobby with Mr. DeLaveaga, yet in reality he is contributing a great deal to science. His name appears often in that monumental work,

FIG. 41. Working the lily pads for black bass, using a fly rod. Near Modesto. Photograph by Perc Meakin.

FIG. 42. Landing a black bass near Modesto. Photograph by Perc Meakin.

"The Natural History of Ducks," by John Phillips. Should someone with means undertake the breeding of song birds on the same scale as that undertaken a number of years ago by Judge H. W. Henshaw, three fields of endeavor, rather than two, might thus be covered.

ACCOMPLISHMENT OF A PRIVATE GAME FARM

About five years ago, Mr. A. P. Hoffschneider of Soulsbyville, California, became interested in the rearing of pheasants. He secured a breeding stock and about four years ago began liberating the surplus in the vicinity of his ranch. Gambel quail have been found as easy to rear as the valley quail. Mountain quail, thus far found very difficult of handling, have also produced young successfully.

DESERT MOUNTAIN SHEEP

Life on desert ranges is not easy. Scant food supply makes desert animals sturdy of limb; lack of suitable hiding places increases danger from predatory species and this increased danger must be cared for by keen eyesight and sense of smell. While taking motion pictures of mountain sheep in Inyo County, Mr. E. S. Cheney had under observation eleven ewes. By October 1, each of these had lost their lamb, although previous to this time, several had been followed by their young. The mountain sheep of desert ranges have not increased greatly since total protection was given them. It is difficult to determine the factors concerned which prevent increase. In the Rocky Mountain region many mountain sheep have died from "lungworm," a common ailment of domestic sheep. The main point is that after long years of protection, mountain sheep are not sufficiently abundant to warrant an open season.

FIG. 43. The mining dredger is a menace to fish. The picture shows how completely the Trinity River was blocked by dredging operations in 1926. It is evident that no migratory fish could successfully pass such an obstruction during low water. Photograph by G. O. Laws.

The birds have become established and there are many reports of successful nesting. Meantime, he has continued to rear large numbers of pheasants and during the past season liberated 168 more.

On this same game farm some 800 quail have been reared in the past four years. Mr. Hoffschneider attributes his success to the food furnished: weed seeds, eggs and lettuce. In one instance this past season, a bantam reared twenty-five out of thirty quail. Even bobwhite quail have been successfully reared and at least twenty-five pairs have been liberated.

JAPANESE SPORTSMEN ORGANIZE PROTECTIVE ASSOCIATION

The Japanese, more than immigrants from other foreign countries, after settling in California, quickly become interested in fish and game resources. A few years ago, a number of law violations were traced to the Japanese, but in more recent years most Japanese have carefully adhered to the game laws.

At Watsonville recently, the Pajaro Valley Fish and Game Protective Association was host to the Japanese sportsmen of the Pajaro Valley. This was the initial step in the formation of a Japanese fish and game protective association. More than forty Japanese sportsmen attended the meeting. Such an organized group is in a position to do much in the line of education and in the protection of game birds and fish.

THE BUCK LAW

New York has been stirred regarding the numerous reports that does are so numerous as to endanger the deer population of that state. Other states have listened to those who claim that there is danger in killing bucks only. Accurate information, however, has not yet been gathered. Until then it seems best to thoroughly test out the buck law before advocating a change. Certainly the buck law has been responsible for less hunting accidents and here in California there has been no evidence of a lessened supply of deer.

Pennsylvania has attempted to put through a bill which would allow the killing of does. However, this met with a great deal of opposition and it failed of passage. Forced to take action of some kind to reduce the number of does, the Pennsylvania Commission proposed to send expert marksmen into the deer country and permit them to kill an unlimited number of does. As in the case of does illegally killed, the carcasses were to be turned over to hospitals. This also met with opposition on the basis that sportsmen who purchased hunting licenses should be allowed to kill the does if it was intended to have a wholesale slaughter.

The buck law in California has many staunch defenders.

FIG. 44. A California deputy on patrol. Deputy William Armstrong of Vallejo, although an old-time law enforcement officer, keeps abreast with the times.

ACCOMPLISHMENTS OF A WOMAN GAME WARDEN

California's only woman game warden, Mrs. Walter B. Sellmer of Fairfax, Marin County, has arrested thirteen people for the violation of the fish and game laws since she pinned a special deputy badge on her blouse, November 22. In each case a fine has been secured and this attractive protector of the state's wild life can point with pride to a goodly sum for fines ranging from $15 to $50.

It may well be said that the ink had hardly dried on Mrs. Sellmer's commission before she arrested a San Franciscan at Stinson Beach for shooting game from a moving automobile. Only a few days after this, her activities brought to the bar of justice another bay city law breaker with a bag of illegally taken song birds. Close on the heels of this case followed another, involving two men who had caught undersized crabs and netted undersized striped bass.

Nor has Mrs. Sellmer been negligent in her attention to less spectacular violations. Through her untiring efforts a trapper, plying his trade without a license, and five hunters, hunting without licenses, have felt the stern arm of the law. Two of these men were found within the Tamalpais Game Refuge openly violating the law of the sanctuary. Another proved to be a mere youth who is now serving a six months' probation.

FIG. 45. Mrs. Walter B. Sellmer, California's first woman game warden. Mrs. Sellmer, as a volunteer warden, has made a number of important arrests.

Mrs. Sellmer's most recent case was made in conjunction with Captain Sellmer and resulted in the apprehension of two deer slayers who so strongly felt the urge to take life that they shot a doe in the Marin woods. Fearful of exposure, the killers cached their illegal game in a tree and wandered on in the manner of those recreation bent, awaiting the cover of darkness. Their capture came about only after a long vigil and real commendable courage and distinguished service on the part of Mrs. Sellmer.

STILL GAME TO EAT

Judging by the last report of the New York Conservation Commission, the taste for game is being at least partially supplied by importation. During 1927, importation agents handled and tagged in the port of New York, 133,909 pieces of domestic and imported game. Game tags to the number of 25,200 were sold to private game preserves of the state. The game tagged consisted of deer, elk, partridge, pheasant, quail, mallards and ducks, together with certain game species from South America.

WILD QUESTIONS

(Questions on the wild)

1. What rodent in California rears the smallest number of young?
2. What California fish is considered the largest member of the minnow family?
3. What large game mammal most successfully withstands open desert conditions?
4. Which of the following are typical diving ducks: canvasback, baldpate, pintail, ruddy duck, mallard, lesser scaup, surf scoter, redhead, shoveller, cinnamon teal?
5. Where may one find muskrats in California?
6. Are wood rats good to eat?
7. What kind of goose has been found nesting at Lake Tahoe and other mountain lakes?
8. Where may California's largest kind of deer be found?
9. What is the proper common name of "black-spotted trout"?
10. Did the buffalo ever range into California?

BOUNTY PAID ON MUSKRATS TO SAVE IRRIGATION DITCHES

The Imperial Valley Irrigation District in Imperial County, which controls and maintains 2400 miles of highline canals distributing water used for irrigation purposes in Imperial Valley, reports that over $10,000 has been paid in bounties for muskrats taken during the twelve-

month period ending March 1, 1928. Owing to damage to levees and loss of water resulting from the habits of these rodents, constant warfare is being waged by trappers employed by this irrigation district, which offers 25 cents per tail taken from each muskrat killed.

VIEWPOINT CHANGES ON ROUTE TAKEN BY DUCKS

In some manner or other most of us have believed that ducks fly north and south on their migrations. Ever since banding was instituted, it has been known that ducks and geese from central Canada sometimes winter in the great valleys of California. Numerous ducks banded on the Bear River marshes in Utah have been taken in California. Now comes additional dependable evidence of this kind. Technical Bulletin No. 32, U. S. Department of Agriculture, is devoted to "Returns from Banded Birds, 1923–1926."

A glance over the returns of various ducks again shows a criss-cross rather than a direct north and south flight. At least six pintail ducks banded in the middle west in Illinois, Iowa, Kansas and Missouri have been taken in California. Four green-winged teal ducks banded on Avery Island, Louisiana, in 1922 and 1923 were taken as follows: Alvarado, Butte Creek, Dos Palos, Yolo County, all stations in California. These birds may well have returned to breeding grounds in the north and taken a westward flight the following year. In three of the four instances, however, they were taken the following winter in California, and the exception two years later.

Two shoveller ducks banded at Klamath Falls, Oregon, were retaken in the Sacramento Valley; in one instance, three months later, and in the other, one year later.

Nineteen mallard ducks banded at Irvington, California, were retaken at the same location a year or two later. One only, of twenty-nine banded, made a long distance flight. This one was taken over a year later at Walla Walla, Washington.

A pintail duck banded at Irvington, January 27, 1926, was taken May 9, 1926, at Rampart, Alaska. Other birds banded at the same location were taken scatteringly over the southern half of the state.

Several pintail ducks banded on Lake Merritt, Oakland, were recovered in the Sacramento Valley the following winter. One was taken east of the Sierra in Honey Lake Valley, and one at Ocean Park, Washington.

SCHOOLS TAKE INTEREST IN CONSERVATION

A few months ago a leaflet was prepared giving salient facts regarding the administration of fish and game resources in California. Given out at the State Fair, it proved effective in stirring interest in the reader. After a lecture at Fortuna High School some of these leaflets were left with the principal. An interesting test was arranged by the principal covering the facts in the leaflet and those furnished by the lecturer of the Division of Fish and Game. Believing that readers might be interested in both the leaflet and the list of questions, they are both appended.

DEPARTMENT OF NATURAL RESOURCES

Division of Fish and Game

Pointed Paragraphs on Fish and Game Administration

In the reorganization of the State government, the Fish and Game Commission now becomes a Division of the Department of Natural Resources, which Department also has jurisdiction over three other divisions—Forests, Parks, and Mining. The Division of Fish and Game is administered by a Fish and Game Commission of three non-salaried members appointed by the Governor. The Fish and Game Commission appoints an executive officer who handles all of the activities of the Division of Fish and Game under the direction of the Commission.

All of the work of the Division in administering and protecting wild life resources of the State is supported solely by hunting and angling licenses, fines imposed by the courts for violations of the fish and game laws, and the licenses and privilege taxes paid by commerical fishermen and fish canners.

The Division of Fish and Game now owns and operates 18 hatcheries and 20 egg-collecting stations. It has under construction at the present time four new hatcheries. The hatchery at Mt. Shasta is the largest in the world. It has 56 ponds and 5 hatchery buildings and is equipped to handle over 20,000,000 trout and salmon. The egg supply of trout is taken partially from brood fish reared and held at the Mt. Shasta Hatchery and partially from artificial traps set in streams and lakes in which mature wild fish are taken and spawned.

The Division of Fish and Game has a patrol force of 125 regular deputies and about 400 special deputies, in addition to the Commercial Fisheries patrol. These deputies work under the direction of Captains. The Captains report to Assistant Patrol Chiefs—one each in the northern and southern districts of the State. The Assistant Patrol Chiefs report to a Chief of Patrol.

The Division has launches and speed boats for patrol on the waters of the bays and rivers of the State and is increasing their numbers as funds permit.

This year, for the first time, the Division is doing its own planting of young fish under the direction of a Supervising Captain. The fish are now consigned from the hatcheries to the Captains of Patrol throughout the State who meet the shipments and see that they are properly planted. The lakes and streams to be planted were determined in advance

by the patrol force, acting in conjunction with the Department of Fishculture.

By next fish planting season the Division hopes that it will be able to eliminate to a very great degree the movement of small fish by fish cars and plant directly from adjacent hatcheries by truck.

Serious effort is being made to survey both from physical and biological standpoints all lakes and streams of the State with a view of determining what waters, barren at present, will sustain fish life. If the biological survey shows these waters to be devoid of food for fish, the food will be furnished and in a few years many extra lakes and waters will be added to our angling area. It is estimated that there are 2000 barren lakes in California at present.

The Commercial Fisheries Department of the Division has charge of all affairs relating to commercial fishing operations in the state. The magnitude of its work can be judged from the fact that San Pedro is now the largest fishing port in the United States and Monterey the third largest. This Department has two patrol boats—one at San Pedro and one in Monterey Bay. It has a force of deputies patrolling the coast and cannery inspectors checking canning operations. In addition, this Department maintains at San Pedro a laboratory for research where it is doing constructive work of the most advanced kind to make determinations as to the supply of fish and to aid in framing legislation to prevent depletion.

The Division has recently inaugurated a Bureau of Research which handles all problems of bird and animal diseases and statistics. The statistical operation of the new deer tag law comes under this Bureau and for the first time California, at the close of this present season, will have available full statistics as to the total number of deer killed, their classification and abundance. Scientists are being added to the Bureau as fast as possible. We now hope to be able to cope successfully with any form of disease which breaks out among our wild life.

The Bureau of Education has been greatly augmented by added lecturers, moving pictures and other methods of disseminating information on our wild life. It is planned to carry this message to the schools and to adults under the maxim that "an ounce of prevention is worth a pound of cure." In this connection it might be well to emphasize the thought that the Division of Fish and Game frowns upon any technical cases made for violation of the law, but believes in educating the public so they will not violate the law. This theory, first put in practice about a year and a half ago, has proven that the people of the State as a whole are certainly back of the new thought.

The Bureau of Hydraulics handles the question of the installation of fish ladders over dams to aid migratory fish in going up-stream for spawning purposes and the installation of screens in irrigation ditches and canals to prevent our game fish from being stranded. This Bureau also has charge of pollution matters. Strenuous efforts are now being made along all three of these lines for the Division realizes fully that it is a waste of money to propagate our fish and plant them unless proper safeguards are maintained to rear them to maturity.

The Division maintains at Yountville, in Napa County, one of the largest single game farms in the world, the construction of which was completed in the summer of 1926. There are eight acres under wire, covering 580 pens. There the Division raises pheasants, quail and partridges and is experimenting with other wild game birds. Last year over 3,000 pheasants were distributed throughout the state and this year approximately 9,000 will be liberated. The first brood stock of Hungarian partridges has been reared. The Division has inaugurated a system of planting game birds unique in the United States in that the liberating is done by our own men by the use of our own trucks, and only on areas set aside as sanctuaries on which all hunting is prohibited until such time as the Legislature shall declare an open season. Plants are made in numbers of not less than 100 birds and the areas contain not less than 10,000 acres. A second game farm is now proposed for Southern California and will be built as soon as a site is selected and in time for next year's operations. Next year should see the liberation of approximately 24,000 pheasants.

Following are a few statistics relating to fish and game in California:

In 1926, there were 256,629 angling licenses sold.

In 1926, there were 252,017 hunting licenses sold.

California has 27 state game refuges containing about 2,000,000 acres of land. Another million acres are contained in National Parks, Monuments and Federal Bird Reserves. Hunting is prohibited on all game refuges. A crew of engineers has just commenced to survey and post all of these refuges.

In the last biennial period, 1924–26, there were planted in our streams from our hatcheries 59,000,000 trout and 14,000,000 salmon.

It is estimated that there are 26,000 miles of fishing streams in California and 10,000 lakes, with an area of over 800,000 acres.

The new hunting license act provides that one-third of all revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds. This will give us a chance to obtain refuges for migratory waterfowl to offset the drastic loss of loafing grounds caused by reclamation projects and the drying up of former flooded areas.

It is estimated that there are at present 150,000 square miles on which hunting is permitted.

Test Given to Fortuna Union High School Students

Test on Visual Instruction and Division of Fish and Game Circular.

If the statement is true place a (+) sign after it. If it is wrong place a (—) sign after it.

1. The members of the Fish and Game Commission are elected by the people of the state at a regular election. ( )

2. The legislature makes an annual appropriation to support the activities of the Fish and Game Commission. ( )

3. The Mt. Shasta Hatchery which is owned and operated by the Division of

Fish and Game is the largest hatchery in the world. ( )

4. Some of the egg supply comes from fish reared for this purpose by the hatchery experts at the hatchery. ( )

5. The Division of Fish and Game is attempting to have a survey made from physical and biological standpoints to determine what bodies of water contain fish food at the present time. ( )

6. A Bureau of Research which handles all problems of bird and animal diseases and statistics has its headquarters at San Pedro where the Department has established a laboratory for this work. ( )

7. The Division of Fish and Game believes in educating the public so that they will not violate the law. ( )

8. The Fish and Game Commission is a Division of the Department of Natural Resources. ( )

9. The Bureau of Education also handles the question of the installation of fish ladders over dams to aid migratory fish in going upstream for spawning purposes. ( )

10. A second game farm has been built and is now operating in Southern California. ( )

Underscore the correct answer.

1. The Fish and Game Commission of California is composed of 2, 3, 5, 7 members.

2. The Division of Fish and Game now owns and operates 12, 14, 16, 18 hatcheries.

3. The Division of Fish and Game operates 10, 15, 20, 25 egg-collecting stations.

4. In 1926 there were more (angling) (hunting) licenses sold in California.

5. California has 9, 18, 27, 36 state game refuges.

6. In the last biennial period, 1924-26 there were planted in out streams from our hatcheries (14 million) (59 million) trout and (14 million) (59 million) salmon.

7. The new hunting license act provides that ¼, ⅓, ½, ⅔ of all revenue from hunting licenses must be spent in the acquisition of land for game refuges and public shooting grounds.

8. Through scientific management by experts at Napa the production of game birds is 2, 3, 4, 5 times greater than it would be if these birds were left to nature.

9. It has been estimated that there are (10,000) (26,000) miles of fishing streams in California and (10,000) (26,000) lakes.

10. The construction of the game farm in Napa County which is one of the largest single game farms in the world and contains eight acres under wire, covering 580 pens was completed in 1916, 1921, 1926.

DANGERS ATTENDANT UPON INTRODUCTIONS OF FOREIGN BIRDS

Success in the acclimatization of various game birds is leading to numerous attempts at supplying a substitute for native species. The average sportsman becomes enthusiastic at the mere mention of bringing in some famous game bird of Europe or Asia. Seldom does he stop to listen to the warning issued by biologists that introductions are always dangerous; first, because of resultant competition with native species; and second, because of the danger of introducing disease. Though in California a policy has been decided upon, yet it is fair that the opposite point of view be recognized. Even if committed to introduction of worth-while species, assembling of all facts bearing on this mooted question is desirable.

A recent article by P. A. Taverner which appeared in *The Canadian Field Naturalist*, October, 1927, discusses the first of these dangers as applied to the competition between the Hungarian partridge and the sharp-tailed grouse. In several of the provinces of Canada, the Hungarian partridge has become well established; whereas, the sharp-tailed grouse seems to disappear in these areas. Mr. Taverner ends his discussion with the following paragraphs:

"Of course all this discussion is now purely academic. The Hungarian Partridge is with us, probably to stay, and it will spread just as far as ecological conditions are favorable, whether we like it or not. If it has introduced disease into native stock, that mischief is done, and is ineradicable now and even the total extermination of the original host would do no good now or at any succeeding date. However, the subject is of great interest and should be closely watched as a guide to policies of the future if for no other reason.

"The disturbing thought is, that no experience of this sort in the now is of much help in the future. Warnings of evil become buried in past literature and unknown to succeeding advisors who have most weight in such matters. In spite of all the disastrous results of introductions in the past, the English Sparrow and the two Starlings in this country, the rabbit in Australia, the Minah in Hawaii and the dozens of other cases that could be cited, attempts at acclimatization and introduction go merrily on by local organizations who know not the dangers and pitfalls that the past has demonstrated. It is well that control of such work be considerably strengthened. There are undoubtedly forms of life to be found elsewhere in the world that would be valuable acquisitions to this country, but the danger of their introduction is great and should not be entered upon without careful consideration as to whether the probable advantage is worth the risk."

In the same number of *The Canadian Field Naturalist*, is an article by L. B. Potter on "The Partridge Versus the Sharptail," in which he cites at least four observers who report conflict between these two species in which the Hungarian partridge was always a winner. He sums up his evidence by saying:

"As a game bird no doubt the Hungarian Partridge is all that its advocates claim it to be. But there is a large, and I believe increasing number of farmers, the writer included, who regard the prairie chicken with special affection, to be encouraged to come around the farm buildings, especially in winter when so few of our birds are with us."

FUR RESEARCH AT UNIVERSITY OF MINNESOTA

With Minnesota one of the leaders in the fur industry, the University of Minnesota has established a research station to further the project in the state.

The station, established at the university by the Bureau of Biological Survey of the United States, will study the diseases of fur-bearing animals, principally those in captivity on fur farms.

Dr. Winford P. Larson, head of the department of bacteriology, says the university was chosen as a site for the station because of the success of independent investigation on animal distempers that had been made by scientists in the medical school.

In establishing the station at the university, the federal government has provided an annual budget of $7,500 for five years.—*The Fur Journal*, January, 1928.

COYOTE NOT STRICTLY CARNIVOROUS

The examination of the stomach contents of carnivorous animals often dispels existing conceptions as to their food habits, as well as proving beyond doubt that a certain animal does certain things that popular opinion does not credit him with doing. The coyote is an outstanding example of this fact. Classed as carnivorous, and generally presumed by the majority of people who are interested in the animal to be all that the name carnivore stands for, it is far from being strictly a flesh eater. As a matter of fact, during the proper season in certain localities, coyotes may abstain from seeking a diet of flesh and subsist, if not entirely, at least nearly so, upon grapes, melons, figs, prunes, dates and manzanita berries. The fact of the matter is that a coyote may, and often does, constitute as great an economic menace to the vineyardist, melon and prune raiser as he does to the sheep and poultry man, because of his fondness for this sort of food. There is abundant and unquestionable proof that such is the case, in the form of records of the stomach contents of every coyote that is captured by the predatory animal control forces of the federal and State Department of Agriculture. These records show that at certain times of the year the animal in question feeds entirely upon grapes in one locality, melons in another, figs in another and prunes in another. In the Imperial and Coachella valleys, for example, there are instances where ripe dates form the chief article of diet, and frequently somewhat elaborate precautions have to be taken to prevent serious losses from this source. Manzanita berries are sometimes the principal article of food of this animal in localities where the shrub abounds.

Coyotes have been captured which were consuming entire grape crops, and the same holds true with prunes; entire crops have been destroyed in some small orchards. The same also is true with melons, of which they appear to be very fond. Figs also appeal strongly to coyotes, and are eaten with avidity. Oftimes one or more fig trees are found on abandoned land holdings in the mountains or foothills, and in all cases, if there are coyotes in the locality, evidence will show that they have been feeding upon the fruit as fast as it falls from the trees. A place of this kind is one of the best locations for trap settings or poison work. In addition to feeding upon fresh prunes and figs, coyotes will at times readily take the dried product, though not in as large quantities as the fresh. As additional proof that coyotes were the offenders in many depredations on vineyards, orchards and melon patches, when the coyotes were eliminated losses ceased entirely.

After all, the coyote is not so much different from a dog in his food habits. After he has been in touch with man and his customs for some time, he adapts himself readly to the prevailing conditions, especially relating to food.

To anyone familiar with the coyote, there is nothing strange or unusual in the fact that fruits and many other things which have not been mentioned are included in his menu.—Charles G. Poole, in *Monthly Bulletin*, Department of Agriculture, January, 1928.

CALIFORNIA'S KILL OF FUR-BEARERS

Fur trapping, one of the oldest industries in the United States, is holding its own in California. This statement is substantiated by the statistics just compiled by the Division of Fish and Game, which show that a total of 278,202 skins netted the commercial trappers licensed by the Division $743,211.52 during the three-year period that ended February 28, 1927 (see table, p. 180).

The figures compiled by the research department of the Division are estimates based on reports of the licensed trappers and do not include animals trapped by

minors under 18 years of age, who are not required to secure a license, or those taken in predatory animal control.

Raccoon skins brought the most money, 39,891 of these pelts bringing the trappers $182,324.45. Skunk finished in second place, 86,273 skins netting $123,244.96. Third comes the much maligned coyote, with 26,183 hides furnishing a revenue of $118,762.41. Mink ranks fourth, the 11,337 skins being sold by the trappers for $67,487.10, while 26,677 gray fox pelts brough $50,608.34.

The most valuable fur trapped was that of the fisher, the skins of this animal averaging $34.75 each for the period, and the 130 that were caught brought the lucky trappers $4,612.34. Next to the fisher the red fox brought the largest price per skin, averaging $18.31, a total of $1,598.87 for the 86 that were trapped. The take of muskrat quadrupled and the value nearly doubled.

After the season on beaver had been closed for several years, it was opened in 1925 and 4019 skins brought the trappers $49,698.95. It is interesting to note that serious inroads were made on the beaver during this period, as the next season's report shows only 692 were trapped and the skins brought $9,530.26. The average price of beaver pelts increased from $12.36 in 1925 to $12.90 in 1927.

During the three-year period three wolverines were taken and the skins sold for $30. None of these animals have been trapped since 1925, according to the reports filed with the Division of Fish and Game.

Twenty-one species are shown in the reports used in compiling the statistics. In addition to those mentioned, the following are included: 18,535 wildcats, 12,495 civet cats, 22,588 muskrats, 8479 ringtail cats, 3578 kit fox, 2050 marten, 1695 badgers, 2033 opossums, 912 weasels, 810 bears, 441 river otter, and 130 mountain lions.

The lion pelts averaged $15.80 each, the total bringing in $3,418.80.

During the 1924–25 period 2984 licenses were issued and 77,787 skins brought the trappers $181,215.13. In the 1925–26 period, the licenses increased to 3530 and 88,185 skins sold for $257,711.42.

Another increase was noted in the 1926–27 period when the licenses increased to 3790 and 112,230 skins were taken, bringing the trappers $304,284.97.

COUNTY WARDENS HELP ENFORCE GAME LAWS

Los Angeles County forestry officers, who were recently appointed special deputy wardens, were very active recently along the south coast. They arrested for the state, nine people for having undersized abalones, four for over-the-limit abalones, two for undersized lobsters, and one for shooting ducks at sunrise. An average fine of $25 each was paid. These cases were mostly tried before Justice of the Peace Billings at Sherman.

Three Japanese were convicted for destruction of evidence and fined $500 each at Sherman Court. These men saw the officers coming and threw the abalones in the ocean. Upon their promise of good behavior and evidence submitted to the court of their past record, the fines were all suspended except $25. A rather lengthy article appeared in the Japanese newspapers relative to this case and it is hoped some good was accomplished, as the Japanese for some time have made every effort to dispose of evidence by throwing it into the ocean and have made it very hard for law enforcement officers to apprehend them. If this practice continues, the Japanese will enrich the State Fish and Game coffers to the extent of many dollars, as these officers are very familiar with the law and will make it interesting for anyone who endeavors to destroy any evidence.

THE LECTURE PROGRAM

An educational program inaugurated to stir interest in conservation should make contact with various groups of people. Although emphasis in the past has been placed upon work in the public schools, yet adults have not been overlooked. Through the months, as a result of demand, emphasis has been swung from srvice clubs to lodges and from lodges to fish and game protective associations. During the months of December, January and February, nineteen lectures have been given before fish and game protective associations. The demand from this source shows that, as never before, these organizations are supporting conservation work and are lending definite aid to the conservation program.

MAJOR CONSERVATION PROJECTS

A number of major conservation projects were stressed at the fourteenth annual National Game Conference, held in New York City, December 5 and 6, 1927. These projects are as follows:

1. Federal legislation. Support of the pending Migratory Bird Conservation bill, known in the seventieth congress as the Anthony-Norbeck bill, H. R. 5467 and S. 1271, and of the McNary-Woodruff forestry bill was urged. Both these measures have been pending in several sessions of Congress, but final action on them has never been obtained.

2. Bear River marshes. Passage of the appropriation bill pending in Congress, providing for reclamation of areas in Utah, in which heavy losses of waterfowl have occurred, was urged.

3. Cheyenne bottoms. Permanent maintenance of this important waterfowl resort in Kansas was advocated.

4. International boundary waters. The Conference declared for the protection of the international watershed between Minnesota and Ontario for perpetual recreational use and protested its exploitation for commercial purposes in such a way as to injure its wilderness value.

5. Cooperation of sportsmen and landowners. The Conference declared that the basis of good will between sportsmen and landowners must be a recognition of the farmer's rights and drastic suppression of the lawless, marauding element which has become so obnoxious. On the other hand, the farmer should recognize a distinct advantage to him in the cooperation of the decent, respectable sportsmen whose license fees pay for patrol and protection of both game and insectivorous birds, and who assist the farmers in preventing depredations of the lawless.

6. Chesapeake-Albemarle Canal. The Conference declared in favor of reconstruction of locks in this canal to prevent destruction of feeding areas of vast numbers of waterfowl by salt water.

7. Coyotes in Alaska. Encouragement was offered the government of Alaska in its efforts to control the invasion of the game fields of that territory by the western coyote.

8. Pollution of waters. Action by the federal and state governments to eliminate and prevent everywhere pollution of lakes and streams, which constitutes a growing menace to finish life, waterfowl and public health, was strongly urged.

9. Importation of game birds. More favorable conditions for importation and transportation of game birds for stocking purposes, by removal of import duties and reduction of transportation rates, was approved by the Conference.

10. Species destructive to game. A study of the vermin question has disclosed the fact that local conditions must be intensively studied and that abundance of game often depends more on keeping destructive species under control than on any other one factor.

11. Scientific research. Investigations, such as the Grouse Inquiry and the Cooperative Quail Investigation, were approved and declared to be the proper basis for conservation methods.

12. Cooperative Game Breeding and Fish Culture. This subject was stressed at the Conference and advocated as a necessary complement to the work of the states and the federal government, in which sportsmen's clubs may help augment the game and fish supply.—*Field and Stream*, February, 1928.

WHAT IS A FORKED HORN?

The article under the above caption in the last number of CALIFORNIA FISH AND GAME called attention to the ambiguity of the law in that spike bucks are defined, and forked horns are defined by using the term "on both sides." Unfortunately, it did not make clear that the discussion had to do with the situation in Modoc and Lassen counties.

THE WEALTH OF THE SEA

Several years ago there was reviewed in these columns a book designed to meet the needs of the fishing industry, entitled, "Marine Products of Commerce," by Donald K. Tressler of the Mellon Institute of Industrial Research (CALIFORNIA FISH AND GAME, Vol. 11, pp. 87–89). Dr. Tressler has now issued a more popular volume under the title "The Wealth of the Sea." In this volume the author has attempted to furnish both information and entertainment in the hope that the book will be of interest not only to those who are primarily interested in marine products, but also to the general reader and to students of commercial geography, biology, geology, chemistry, oceanography and navigation. Descriptions of technical processes are simple and brief. The scientific names and technical terms have been largely omitted.

The first chapter deals with the area and depth of the ocean, temperature, salinity, pressure, movements and life of the sea. One learns that the extent of the sea is 139,000,000 square miles; that the average salt content of a gallon of sea water is about a quarter of a pound, and that surface fishes down to seventy-five fathoms are colorless. From 150 to 250 fathoms, they are silvery or gray in color, and at depths where little light penetrates they are black or at least dark colored.

The next chapter cleverly shows how the sea and its products enter into our daily life. It is surprising to learn how many household articles have been finished with fish oils. "When we rise in the morning we may use a soap made from fish or whale oil for our bath. The razor we shave with was tempered in fish oil. The cold cream or other toilet preparation used after we shave contains glycerin which may have been obtained from menhaden or some other fish. We put on shoes which were finished with menhaden oil.

"We go to our door, painted perhaps with a salmon-oil paint, and get a newspaper printed with ink made from fish oil and lampblack. If we eat herring or mackerel for our breakfast, we obtain much nutriment from the fat and vitamines of the herring or mackerel oil.

"We may ride to work in an automobile painted with a baking japan containing fish oil, and sit on imitation leather seats prepared by the use of menhaden or other fish oil. Even if the car has real leather upholstery, fish and fish-liver oil were used in the final tanning and finishing processes.

"We enter our office building painted perhaps with menhadden oil paint, containing driers made from fish oils. The linoleum on the floor may have been made with fish oil. The greases used in the lubrication of the elevator machinery probably contain fish oil.

"If it is raining when we come from work in the evening, we put on a raincoat which may have been made from cloth covered with many coats of a fish oil varnish.

"Our feet may get wet on the way home. To prevent catching cold we take a tonic. One of the best we may choose is cod-liver oil, which contains the fat-soluble vitamines needed to build up vitality and resistance to disease.

"Perhaps we shall have candles on our dinner table; if so, it is likely that they were made from stearin obtained from fish or whale oil. Our furniture may be finished with a menhaden oil varnish. And the oilcloth which covers the kitchen table was probably made by painting cloth with special menhaden oil paints.

"When we prepare for bed we put on slippers made soft and comfortable by treatment with fish and fish-liver oils, and as we switch off the electric light we may touch an imitation rubber knob of fish oil composition."

Other chapters deal with the manufacture of salt from sea water, iodine and other chemicals from seaweed. A chapter each is devoted to pearls and imitation pearls and to precious corals; a discussion of fishes and their preservation and of America's fisheries follow; and chapters on various mollusks, crustaceans, whales, fur seals and sponges conclude the volume.

Dr. Tressler has furnished a 340-page illustrated volume which gives a comprehensive and fascinating story of the nature, uses and economic importance of the various products which come from the sea. The information is authentic and the story of whale hunts, pearl diving and deep sea fishing makes the book attractive to everyone.—H. C. Bryant.

CALIFORNIA HUMMINGBIRDS

A most enlightening and interesting article bearing on the hummingbirds of California, which are among the smallest in size of one of our large American bird families, is that by Mr. Robert S. Woods, appearing in a late issue of the *Auk* (Vol. XLIV, No. 3). Mr. Wood prefaces his very full report with the statement that, although the hummingbirds "include some 500 species, but nineteen have been found within the United States, and of these only one occurs east of Texas and the Rocky Mountains. Of the nineteen, two species, both of which are taken in California, are thought to have been mere adventitious hybrids, while nine are restricted to within 100 miles of the Mexican border in Arizona, New Mexico and Texas * * * of the remaining eight, which may be considered more definitely a part of our fauna, six species are of common occurrence over large portions of California, while the seventh has also been found within the borders of the state."

The fact is brought out that, although green is the prevailing color on the throats or other luminous parts of the plumage of the Mexican, Central American and West Indian species, this color is not found on the throat of any of the eight hummingbirds whose range is largely within the United States. The gorget is red in four of these; in two it is reddish or rose pink and in the remaining two, violet, and note is made of the fact that in the 140 species listed in Mr. Ridgeway's "Birds of North and Middle America," the red color appears in only five or six species, and does not appear in any of the thirty species living in or near the Panama Canal Zone. The impression is thus obtained that northern latitudes are in some way conducive to the development of the red areas in the plumage of this bird family and "this impression is strengthened when we consider that the Rufous and the Ruby-throated hummingbirds, which reach the highest latitudes in summer, and likewise Anna's and Allen's hummingbirds, which winter farthest north, all have red gorgets, while the Rufous hummingbird, the hardiest pioneer of all, is unique in the reddish color of its back as well. Despite the predominance of yellow flowers, pure yellow is entirely lacking in the plumage of North American hummingbirds."

The brilliancy and variation of the coloring in the two California species of the genus *Calypte*, Costa and Anna hummingbirds, overshadows the scarcity in numbers of this family in California, compared with the many in South and Central American countries. The changing hues.

affected and reflected by varying conditions of light; the brilliant rose-pink gorget, enhanced by a border of rich gold of the Anna; the wide variation in the coloring of the Costa; the burnished gold of the rufous and the reddish-purple of the calliope, coupled with the interest which attaches to this particular bird from its being the smallest of our birds, make one who possesses an appreciation for color, ever sensible to the wonders of this species.

Several pages are devoted to description of the flight of the different species; the elaborate nuptial flight of the Anna, that of the Allen; the shuttling of the black-chinned, which follows the path of a narrow figure 8 lying on one side; the hovering of Anna's "motionless in the air with body nearly horizontal, suddenly rise rapidly and vertically, as if by a reversal of the force of gravity, is to obtain some idea of the bird's remarkable mystery of the air."

The occurrence of the species in California is given and Mr. Wood's particular observations of the birds in San Gabriel Valley are cited.

Intimate and full life history details are given, with more especial note to the "family life" of the Costa, which Mr. Wood simply disposes of by saying that "he has none," because his experience has shown that the male Costa has never shown enough interest in family affairs to indicate his relationship with any particular brood, "his mate, however, making up his deficiencies and finding no difficulty in managing the household without his aid."

Much study has been given to the location and construction of the nest of these birds; their eggs and behavior of the various individuals while brooding.

The mentality of the hummingbird, a much mooted question, is discussed at length, Mr. Wood quoting largely from Mr. W. W. Hudson in his comparison of the bird with insects and dragon flies, all of which Mr. Wood has not found to be convincing, and, although he, too, has not been able to detect any indication of the hummingbird possessing any reasoning power—"an accomplishment which, after all, is rarely enough displayed even by the human race—and that it may be lacking in some of those finer emotions which make many of the birds seem so akin to mankind, nevertheless its actions and attitude, its alert interest in its surroundings, its apparent love of sport and its ability to recognize those who befriend it, certainly furnish competent evidence of an acutely conscious intelligence."

The article is amply illustrated with excellent photographs.—B. W. Kibbe.

CANADA LEADS IN BUFFALO CONSERVATION

The preservation of the American buffalo has been undertaken naturally by the two governments and peoples most interested, that is, the United States and Canada, but the latter from the beginning of the work has been in the lead. Of the 16,000 buffalo now existing, there are 12,000 in Canada and some 4000 in the United States.

In all the history of animal life, there has been none as extraordinary as that of the American bison and its near extinction in a short period of years. It numbered nearly fifty million head, which far exceeded that of any known species of large quadruped. Its range was practically from the Atlantic to the Pacific and north to the barren grounds of the Arctic and south to the twenty-fifth degree of north latitude, being nearly to the Tropic of Cancer.

The animal authority, Dr. Edward W. Nelson of the United States Biological Survey, in his book "Wild Animals of North America" (p. 461), writes:

"When the American continent was first discovered (1492), their numbers were from thirty to sixty million. In 1870 there were still about five and one-half million; these were practically all exterminated by 1890, there remaining in all about 800 buffalo in private hands."

Some have questioned how could anyone know that the above figures of millions were anywhere near correct. In the book "Reminiscences of a Sportsman," by J. Parker Whitney (p. 162), he writes as follows:

"A competent authority has estimated that between the years of 1868 and 1880, two and one-half million dollars were paid out in the three states mentioned (Kansas, Nebraska and Missouri) for Buffalo Bones gathered on the prairies at $8 per ton, and if the estimate of 100 buffalo to one ton of bones has been correctly calculated, it will be observed that the bones of over thirty millions of buffalo would be required to furnish the amount purchased." If three states furnished thirty million head, then another twenty million for all remaining territory is conservative. The estimate of twenty pounds of bones to each animal, being ten for the skull and ten for the rest of the animal, is also reasonable.

The range of the buffalo to the south being nearly to the tropics, is proved by a book, "Sport with the Rod and Gun," published by The Century Company in New York, 1883, in which is an article by General Lew Wallace, author of "Ben Hur," who took part in a hunt. He reported a herd of several hundred ani-

mals and they bagged seven buffalo in one morning's hunt. It was in the year 1867 just after the Civil War, and he was making a horseback journey across Mexico from Monterey, the hunt being near the town of Hornos, State of Coahuila, about 500 miles southeast of El Paso, Texas, the latitude being about twenty-five degrees north, about ninety miles from the Tropic of Cancer.

To tell now what Canada has done for this great animal. In 1907 the Canadian government bought the Michael Pablo herd in Montana and moved the 709 buffalo to their new park at Wainwright, Alberta, by railroad. This took three years and it was not until 1910 that the last were transferred.

In sixteen years these 700 head increased to 12,000, of which some 2000 annually have been disposed of commercially in order to offset the increase. Wainwright Park can not reasonably support a larger number than 5000 animals.

During the last three years the Canadian government has moved about 2000 animals some 700 miles to their new Wood Buffalo Park, which is on the Slave River, being a tract of some 100 miles square which has been occupied by the original herd of about 1500 of the "Wood buffalo." The transfer was started in 1925. Movement during June to August amounted to seven loads and it took about one week of rail and steamer on the Peace River to make the transit. About 2000 were transferred each year in 1925 and 1926. The experiment was most successful.

The history of the original herd of Peace River Wood buffalo is most interesting, as this is the only remaining wild herd; except a small remnant in the Yellowstone National Park, Wyoming. The first authentic report was about forty years ago by the Canadian explorer, Warburton Pike, who saw the herd on his trip after musk-ox in 1890. Various reports are as follows:

		Estimate
1890	Warburton Pike	100
1894	Casper Whitney	150
1907	Ernest Seton Thompson	625
1920	C. Gordon Hewitt	2,000
1922	Fullerton Waldo	2,500
1924	Royal Geographical Society	2,000
1926	American Bison Society	1,500

The above, of course, are only the estimates of casual visitors based on the reports of the guardians or custodians of the herd. A few years will probably show a herd of 10,000 buffalo in Wood Buffalo Park, on Slave River, Canada, which will become a valuable basis of supply for meat, hides and other products.

In the United States the American Bison Society was organized in 1906 and has done splendid work, though on a smaller scale. The first annual report of buffalo was compiled by Dr. W. T. Hornaday in 1903. The totals of all the pure-bred American bison in the world are as follows:

1903—1,753 buffalo in the United States and Canada.

1921— 9,311 buffalo in the United States and Canada.

1923—12,521 buffalo in the United States and Canada.

1927—16,417 buffalo in the United States and Canada.

There are seven of the small eastern states which have no herds of buffalo on exhibition, but otherwise this animal is well distributed throughout the United States.—M. Hall McAllister, San Francisco, California.

THE IRISH ELK

Through the generosity of Mr. William M. Fitzhugh, a trustee of the academy, the Museum of the California Academy of Sciences, in Golden Gate Park, has acquired a head of the gigantic extinct Fallow deer (*Cervus giganteus*), commonly known as "Irish elk." This prehistoric animal was one of the largest of the deer, standing six feet or more in height at the shoulder, and second in size only to the moose, among present-day species. In spread of antlers it even exceeded the moose, some skulls having been found with antlers that were twelve feet across; six feet is an exceptionally wide spread for a moose.

The Irish elk lived ages ago in western Europe, in England and in Ireland. Most of the specimens in museums were found in peat bogs in Ireland, where the carcasses happened to sink and the skeletons thus became more or less perfectly preserved.

The academy specimen from Ireland is a fine example of the species in excellent condition and with antlers that spread more than eight feet across. It is now on exhibition on the wall of the Mammal Hall in the Museum.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA, A PROCLAMATION

For several years a special week has been set apart for public discussion of our forests and of what must be done to safeguard and restore them. Among the agencies making for progress in this direction, American Forest Week has proved its usefulness and I am glad to proclaim it again and to announce that Canada is

again concurrently observing a similar week.

The rehabilitation of our forests demands first of all that the forest fire evil be suppressed. Many of the forested States, with the cooperation of timber land owners, have undertaken organized protection against forest fires; and in recent years, under the Clarke-McNary law, the Federal Government has given its support to the movement. This great cooperative enterprise must be extended and strengthened until every forested county in the United States is safeguarded against forest fires.

But we are still far from the goal of complete protection. Every year, on the average, 80,000 fires scourge our woodlands, steadily undermining their vitality. For this bad situation, the blame falls equally on us all. Public agencies rarely provide adequate protection against fire, the timber land owner is too often indifferent to his property, the forest worker is too often neglectful of the future forest, the average citizen is too often careless with fire in the woods. We must all gain such respect for the forest that its destruction through indifference or carelessness shall be unthinkable.

We can not permanently abuse our forests with impunity. The soil is the ultimate source of all our wealth and of life itself. One-fourth of our American soil is best suited for forests. Much of this land is already idle. More of it is being made idle by destructive logging and fire. Yet we can not safely permit our forest land to lie fallow and useless any more than we can permit our farms and factories to lie idle.

To make our vast empire of forest land fully productive of continuous crops of timber will have momentous consequences in our national life. It will give agriculture the advantage of a new and valuable crop. It will afford permanent employment to millions of men in the forest industries. It will provide raw materials for many industries. It will furnish traffic for our railroads. It will maintain foreign and domestic commerce. It will restore our forests as conservers of soil and water, and as givers of health and pleasure to our people.

We already have made a beginning in forest renewal; but the task is stupendous and we should permit no satisfaction over what has been done to blind us to the magnitude of what remains to be done.

Now, THEREFORE, I, Cavin Coolidge, President of the United States of America, do hereby designate and set aside as American Forest Week the week beginning April 22 and ending April 28, in this year of 1928. I recommend to the Governors of the various States that they also designate this week for special observance by all our people; and that, where practicable and not in conflict with law or custom, Arbor Day be observed during the course of the same week. I urge that during that week all citizens and appropriate organizations—including public officials, legislators, business organizations, educators, editors, clergymen, landowners and others—give thought to the preservation and wise use of our forests, to the end that energetic forest policies will be adopted in all communities.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this twenty-fourth day of February, in the year of our Lord, one thousand nine hundred and twenty-eight, and of the Independence of the United States of America the one hundred and fifty-second.

By the President:

CALVIN COOLIDGE.

FRANK B. KELLOGG,
Secretary of State.

PUBLIC WARNED TO GUARD AGAINST TULAREMIA

Tularemia, a serious and often fatal disease, known also as "rabbit fever" or "deer-fly fever," has spread so widely that Paul G. Redington, Chief of the Biological Survey of the United States Department of Agriculture, has issued a warning to all field men of the department to be on guard against it. The department is making public this warning for the benefit of sportsmen, lumbermen, cattle and sheep tenders, farmers and others of the general public who may come in contact with the disease. Mr. Redington's warning has been endorsed by the United States Public Health Service.

"Tularemia," Mr. Redington explains, "is a plague-like disease of rodents transmissible to man. Of 500 human cases reported in the United States, 20 have terminated in death."

Cases of tularemia have been discovered in all states except Washington, Wisconsin, New York, Delaware and the New England States. It has been established definitely that the disease is caused by an organism, *Bacterium tularense*. In nature the disease affects jack rabbits, snowshoe rabbits and cottontail rabbits. This provides a reservoir for infection of both wild animals and human beings. No cases have yet been recognized in commercial rabbitries, and care should be exercised to avoid the introduction of

tularemia into such places. There is no danger of contracting the disease from eating rabbit meat if it is thoroughly cooked, even though the animal may have been infected.

In the western states the disease is carried from animal to animal and from animal to man by the bites of infected deer flies and ticks. Ticks also act as carriers in the southern states. Men also become infected by handling rabbit carcasses, as in dressing them for the table or cutting them up to use as food for animals or bait in fishing or trapping. In the east, such direct contact is the common means of infection.

For protection against tularemia the best known precaution is the use of rubber gloves when handling or dressing rabbits, or when skinning other animals that may be infected with the disease. In the open it is wise to exercise care in avoiding the bites of deer flies, ticks or other possible carriers. Wearing rubber gloves is not an absolute protection, for skilled laboratory workers who are scrupulously careful because they are aware of the dangers, often contract infection. Rubber gloves should be worn in handling fresh skins. Dried skins are not likely to carry infection. One attack of tularemia confers immunity to man, hence those who have recovered from the disease should be employed, wherever possible, in occupations where there is risk of infection. No protective vaccine has been developed as yet.

In addition to the wild rabbits most affected by tularemia, and man who may contract the disease, scientists have discovered cases of tularemia in California ground squirrels, Columbia ground squirrels, Utah ground squirrels, desert ground squirrels, pine squirrels, yellow-bellied chipmunks, pocket gophers, woodchucks, opossums, cats, porcupines, house mice, deer mice, meadow mice, wood rats and coyotes, and susceptibility is being investigated in other animals. All possible carriers of the disease should be handled with care.

Mr. Redington also warns of the danger of liberating wild rabbits trapped in one locality for the restocking of hunting areas. When restocking seems desirable, a quarantine should be maintained and no rabbits should be liberated for about ten days, to give the disease time to develop in the imported rabbits, which it will do usually in five or six days if they are infected. Otherwise the diseased rabbits are likely to cause a rabbit epizootic, reduce the game available for hunting, and create a center of infection from which human beings may contract the disease.

In man tularemia is likely to manifest itself first by pain, tenderness and a swelling of the lymph glands draining the region where the infection occurs, as those of the elbow or armpit when infection has occurred on the finger. These symptoms are likely to develop within two to five days after infection. An inflamed and painful ulcer may soon appear where the insect bite occurred, although in some cases this does not happen. The development of the disease is likely to be accompanied by sudden onsets of headache, aching pains, chills, prostration, general weakness and fever.

DENMEAD AND GOLDMAN DISCUSS PROBLEMS OF GAME PRESERVATION

The comparative merits of restocking hunting areas with imported game and the protection of game already in the area, were discussed by Talbott Denmead, Deputy Chief United States Game Warden, at the Fourteenth National Game Conference held in New York early in December, and E. A. Goldman, also of the Biological Survey of the United States Department of Agriculture, explained to the conference members some of the factors leading to the numerical fluctuations of game.

Mr. Denmead particularly emphasized that his remarks should not be taken as a criticism of state conservation commissioners and others who have been active in importing game for restocking purposes, but rather to emphasize the need of keeping account of the results of importations to decide whether the practice pays. As a result of his experience, he was inclined to the opinion that further protection of existing game should be paramount and importation secondary. He noted that game brought from a distance is liable to injury in transit, is more susceptible to disease, or because of conditions of transit and unfamiliarity with the country may die or be killed after liberation. Even if animals stand shipment in good condition, "there still remains the doubt whether they will become acclimatized and adapt themselves to weather and food conditions; and there is still further danger that they may be entirely wiped out by reason of their unfamiliarity with the country and lack of knowledge of their enemies known as vermin."

The warden recounted several unsuccessful importations, and stressed the additional danger of introduction of fatal disease by imported birds and animals. He quoted with approval M. D. Hart's statement of conditions in Virginia: "We have the ruffed grouse, the wild turkey

and the quail—three of the finest game birds on earth. It will pay us to take care of them and not import foreign birds."

Protection instead of importation "may make the State game officer's account look like too much overhead if more money is expended on game wardens and the destruction of vermin and less on birds and animals for liberation, but results are what count in the long run and are what the hunters are looking for and expect. Large numbers of animals and birds imported and released may look good in annual reports, but the question to be answered by every State game authority is, does it pay?"

Instead, Mr. Denmead recommended a more thorough and intelligent control of vermin and the establishment of permanent game sanctuaries, with restocking of depleted covers with imported game only when and where it can be done successfully.

Mr. Golden, in charge of the Division of Game and Bird Reservations of the Biological Survey, in discussing fluctuation in the numbers of birds and animals as one of the most pressing problems of wild-life administration, said that some of the factors were easily understood and could be controlled, but that other factors that may depend on the weather and those that are involved in biological relationships are often baffling in their complexity.

He mentioned various studies of numbers of game and thought it doubtful that a stabilized balance under natural conditions was ever attained for a long period. Records of abundance in furs delivered to the Hudson's Bay Company for a hundred years show cycles of abundance and scarcity.

Whatever other effects there may be on the numbers of game, the presence of man has disturbed the former balance, and as an offset "suitable areas must be set aside or created for the benefit of game, in which all breeding stocks are preserved, if game is to be maintained on anything like a satisfactory scale, and a surplus provided for sportsmen."

The speaker gave consideration to damage done by predatory animals and vermin, the extent of which is not generally realized, and also discussed some of the reasons for the wide fluctuations in the numbers of such well-known herds as the Yellowstone elk and the Kaibab deer, and for the increase of mountain sheep on the National Bison Range, in Montana.

"Sufficient food and water and adequate protection from enemies are essential," Mr. Goldman remarked, "if game is to thrive and be maintained on a satisfactory scale, but freedom from parasites and diseases, especially those that become periodically epizootic, and, in waterfowl, freedom from maladies believed to be due to mineral poisons, is of vital importance. Parasitism may account for the comparative rarity of some animals, including various members of the weasel family that, especially in the warmer regions, apparently are able to obtain abundant food, and, so far as known, have few natural enemies. Epizootics evidently provide the final check to overabundance in all wild life, and correspond to epidemics in man."

TERN BANDED IN LABRADOR FOUND DEAD IN FRANCE

Another trans-Atlantic flight—and probably a "nonstop" one—has come to light. A communication received by the Biological Survey of the United States Department of Agriculture from Prof. Robert Poncy of Geneva, Switzerland, incloses a clipping from *Le Chasseur Francais* to the effect that M. Robert Pradier, of Port-Dauphine, La Rochelle, France, found, on October 1, 1927, on the Greve de Marsilly, near La Rochelle, "a kind of black-headed gull, known in the region as 'hirondelle de mer,' or sea swallow," and carrying on its right foot an aluminum ring with the inscription, "Notify Biol. Surv.," and the number 548656. M. Pradier would be glad to learn, the account said, the habitat and name of this bird, as well as the date on which it was banded.

The Biological Survey, which supervises the bird-banding work in the United States and Canada, finds in its records that band No. 548656 was that of an Arctic tern (*Sterna paradisaea*) banded when it was between 1 and 5 days old at the Red Islands, Turnevick, Labrador, on July 22, 1927, by Oliver L. Austin, of Tuckahoe, N. Y., who at the time was on an expedition to Baffin Island in connection with which he was banding birds on their northern breeding grounds for the Biological Survey. The straight distance from Labrador to the coast of France is about 4200 miles, a remarkable travel record for so young a bird.

This is the second transoceanic bird return in the records of the survey, the first being that of a common tern (*Sterna hirundo*) banded as a nestling on the coast of Maine in 1913, and recovered four years later in the delta of the Niger River, on the west coast of Africa. Several other remarkable distances have been traveled by birds recovered from South America. The Biological Survey has about 1000 volunteer cooperators scattered throughout the United States and Canada

who are helping in the bird-banding work, by means of which valuable data are being collected for the solution of problems regarding the migratory and other habits of wild birds.

NEW LEAFLET TELLS HOW TO RAISE MINKS IN CAPTIVITY

Comparatively few persons are raising minks in captivity, even though the fur has sold for high prices during the past ten years, according to Frank G. Ashbrook, biologist of the Biological Survey, in a leaflet on "Mink Raising," just issued by the United States Department of Agriculture. A keen interest has been manifested in mink farming, he says, since the beginning of the present century, but it has been spasmodic rather than sustained. Mink farming is not altogether in the experimental stage, however, for minks have been raised successfully in captivity, and the quality of fur produced on farms is in no way inferior to that trapped in the wild.

Minks are very prolific, and when fed and handled properly they breed and produce young regularly, their litters numbering usually six, seven or eight. Young minks born in captivity are much superior for breeding stock, and consequently the prices asked for ranch-raised minks are often higher than prospective mink farmers care to pay. Those who have made money in mink raising thus far have sold the animals chiefly for breeding purposes. Further experiments will be required before it can be determined whether raising these animals in captivity as fur producers can be made profitable.

The new leaflet No. 8-L describes minks and their habits and gives information on selecting a ranch site, making pens and dens, breeding, mating, feeding, and killing and pelting. Copies may be had free upon request addressed to the United States Department of Agriculture, Washington, D. C.

BIRD-CENSUS TAKERS WANTED

Bird students are invited this year, as in the past, to assist the Biological Survey of the United States Department of Agriculture in taking censuses of breeding birds on tracts convenient to their homes. Such a census of birds means an exact and complete enumeration, by species, of the birds that actually nest within the boundaries of a selected area. It does not include birds that merely visit the tract, birds that nest near but outside the boundaries, and migrants. It will be seen that a thorough familiarity with the birds of the region is needed to take a successful census. Bird censuses become particularly valuable when the volunteer enumerator counts the birds making their homes in the area for five or more years in succession. In the latitude of Washington, D. C., and St. Louis, Mo., the count should be made about June 1, and correspondingly earlier or later south or north of this line.

A suggestion as to the most effective way to take the census is that a count be made of the singing birds very early in the morning, with a recount on one or more mornings in the course of the next few days. Bird-census reports are desired on many types of land, such as farm lands, woodlands and forests, near irrigation projects, in marshlands, and on the shores of rivers, lakes and the sea, and in special areas such as city parks, cemeteries, bird sanctuaries and other spots having a dense population of birds.

Anyone interested in the taking of a bird census may write to the Biological Survey, United States Department of Agriculture, Washington, D. C., for directions, census blanks, and a return envelope that requires no postage for mailing the reports.

ANSWERS

(Questions on page 147)

1. The porcupine.
2. Squawfish or "Sacramento pike."
3. Prong-horned antelope.
4. Canvasback, ruddy duck, lesser scaup, surf scoter, redhead.
5. Eastern Modoc County and Eagle Lake, Lassen County; Imperial County; Buena Vista Lake, Kern County (probably introduced).
6. Yes. In Mexico they are sold for food.
7. Canada goose or "honker."
8. Modoc County.
9. Cutthroat trout.
10. Yes. Eastern Modoc and Lassen counties.

COMMISSION ACTIVITIES

Department of Patrol

The old adage of a man profiting by another's loss was well exhibited in San Francisco on Saturday, January 21, when a systematic raid on the ice boxes of clubs and markets resulted in a collection of 250 ducks and 50 geese. In order to enforce the closed season and prevent the nonsale of wild game, it is imperative that a time limit must be set within which birds taken in open season must be consumed. In the case of ducks and geese, five days are imposed by law as the limit of grace.

Search of the numerous storehouses of ducks and geese throughout the city, five days after the close of the season, disclosed many limits, all properly tagged, some bearing the names of well-known sportsmen whose good sportsmanship has never been questioned. As soon, however, as the respective owners found that they had forgotten to remove their game from storage before the deadline, they all, with one accord, manifested a spirit of charitable sportsmanship when they learned that the birds were turned over to the San Francisco Relief Home. At their expense the patients enjoyed a real feast, for wild game is seldom on the menu.

The revival of the old sport of trapping game birds is being met with determined resistance whenever practiced in the state. Hulbert Toole, a resident of Santa Paula, Ventura County, persisted in trapping quail, carefully cared for by interested residents, until their dwindling numbers caused suspicion that they were being trapped. A plan of capture was devised by Deputy Walter Emerick, assisted by volunteer deputies Walter Claberg and Lawrence Gardner, which lead to the arrest of the offender. Judge Hawthorne's court at Fillmore imposed a severe fine of $150, with the view of discouraging such operations in the future.

The efforts of Deputy J. W. Thornburg to check the trapping of quail in Riverside County resulted in the discovery of an extensive system of traps. These were made of one-inch mesh chicken wire attached to old iron tires of a spring wagon, once a familiar vehicle. The approaches were covered with dirt and leaves and corn was used as bait. In one trap, Deputy Thornburg found twenty-five birds making a fruitless effort to escape.

The diligence and vigilance exercised in minimizing this illegal method of taking game is worthy of the highest praise.

Two Los Banos citizens, one a hotel proprietor, the other a special deputy sheriff and former employee of Miller and Lux, were arrested early in January as a result of the persistent efforts of the Division to prevent the selling of wild game. Jack Twigli and Curry Anderson were apprehended, following information that they were selling ducks, and the raid systematically made on their establishments revealed a large number of birds in their possession. Previous to this raid, an investigator of the Division had purchased ducks from both of the offenders.

Judge D. E. Hales, of Gustine, imposed a fine of $100 on each offender. It is hoped that such sure and swift justice will deter others from engaging in this pernicious practice.

The versatility of deputies was again shown in the recent installation of a "duck hospital" on Buena Vista Lake. Captain M. S. Clark, together with deputies L. Arnold, A. R. Ainsworth and Ray Ellis, in three days caught some 200 ducks suffering from disease. The sick ducks were then placed in an enclosure, where good care, abundance of fresh water and a changed diet resulted in the recovery of about 90 per cent of those affected.

All of the surviving birds were banded with Biological Survey markers and liberated. Thus, not only were a large number of birds saved by reason of the energy and promptness of the field forces, but another splendid opportunity was afforded to advance the knowledge of bird migration.

"The ways of man are wonderful and sometimes past finding out." This was admirably illustrated in a letter received recently by J. S. Hunter. The letter stated that the writer had violated the game laws of California over a considerable period of time and now wished to make amends. He was advised of the minimum fine for hunting without a license. In paying this "conscience money" the reformed violator expressed the wish that it be donated to a specific charitable organization, "as they are the

people that told me how to be saved and keep saved."

Efforts to preserve Pismo clams from reaching depletion have met with such success that the outlook for the future of this important bivalve fishery is encouraging. Not many years ago, commercial diggers used horses and plows on Pismo Beach, and great waste attended this method. Signs of depletion soon became evident. Even at the time when the present law stopped the shipment of clams from Pismo and Morro beaches, 274,317 pounds were exported annually.

Much special attention has been given to the enforcement of the present law. Warnings were issued concerning the procedure that would be followed in case of violation. As a result of this, a much better feeling among the local residents has been brought about. Judges, too, have manifested a better spirit and shown greater willingness to cooperate. There yet remains considerable indifference on the part of small colonies of clam diggers on Pismo and Morro beaches, who persist in digging over the limit.

The apprehension of these violators has been vigorously carried on by Special Commercial Fisheries Deputy Ross W. Markley and Deputy H. E. Black. As these deputies are known to the clam diggers, their endeavors are rewarded only after long hours of watchful waiting and persistent efforts to outwit the diggers. For instance, Deputy Black apprehended Pete Lee, whose left foot had only four toes, by tracking his footprints to a cache where he had buried several overlimits of clams. Again, after patient watching with glasses from a vantage point, Deputy Black witnessed C. E. McDonald take two limits of clams and then conceal them in the false bottom of an automobile. The arrest of another clam digger at Morro Bay by Deputy Markley came about only because Markley was mistaken for a tourist by the lookout of the colony, "One-eye Ellis."

Efforts to restore the depleted covers of San Diego County are encouraging. Some 400 valley quail were trapped at the Point Loma Homestead by A. W. Elder of the Game Farm, assisted by deputies Webb Toms and E. H. Glidden. The San Diego Zoological Society and the San Diego Fish and Game Protective Association aided materially in making this work successful.

Volunteer Deputy Otto Broeker caught a member of the Alameda Duck Club in the duck fields with sixty-seven ducks. After hiring an attorney and using all the influence that could be brought to bear to be absolved from his act, and failing to secure the sympathy of the Division, the violator plead guilty and was fined $250 by Judge Colthurst of Vallejo.

Snow and ice in the northern regions of the state have caused many hardships in law enforcement. Deputy Brice Hammack of Fort Jones, for example, was under the necessity of making a trip by way of Oregon to catch G. B. Crabtree, who had on hand a considerable store of deer meat.

Deputy Walter I. Long of Westwood made four deer cases in the vicinity of Loyalton and Calpine. Later, in cooperation with Deputy Barnes, he arrested two Indians for the killing of a forked-horn. The carcass was skilfully hidden and the Indians made the two wardens pay a heavy price in the expenditure of physical energy to effect their capture.

A splendid fine of $150 was secured by Deputy A. D. Miner of Quincy for deer meat which was held in possession out of season. Judge Taylor of Taylorville imposed the fine.

Judge Rohrback assessed a fine of $100 for a similar offense. The arrest was made by Deputy F. H. Post of Salinas.

Deputy V. E. Von Arx, Sebastopol, caught a man in the act of using a salmon as a target for pistol practice. This cost the violator $100.

Deputies C. M. Bouton and C. F. England, operating with the launch *Quinnat*, caught a violator using small mesh net, and secured a fine of $100.

KMN, the Division's radio, contributed materially to the arrest of a commercial duck club operator shortly after the close of the duck season. Rumors, crystallizing into reliable reports, reached the ears of Captain S. J. Carpenter, at Maxwell, that Vencel Novotny was operating the Heffelsteine and Gordon Duck Club, near Williams, in open violation of the game laws. Such turned out to be the case, for Novotny was caught with more than the legal limit of geese in his possession. Hailed into the court of Judge George B. Reckers, at Williams, he was fined $50 and his permit and license canceled.

Unfortunately, this fine failed to heighten the offender's respect for the law.

office that Novotny was trying to secure another license and attempting to have a Radiograms informed the San Francisco friend secure a permit. Search of the records revealed the application and its issuance was held up. Meanwhile, operators of the Division, suspicious of Novotny's character, applied to him for a "shoot." Their desire to have a duck hunt out of season met with ready encouragement and they were told to call the next day. They did so, and a fee was accepted. All this time, radio messages filling the air between Maxwell and the central office, were quietly, yet quickly and surely, exposing all of Novotny's pretty schemes. On January 11, he found himself again facing Judge Reckers, charged with operating without a permit.

In addition ot a fine of $200, Judge Reckers imposed the injunction that should Novotny violate the law within the next six months, he would find himself serving a 200-day jail sentence.

The launch patrol, which is made up of five men, have to their credit seventy-five cases covering the period of October 17, 1927, to March 1, 1928, which netted $2,350 in fines. Six cases are still pending. Twenty-four nets were seized with a total footage of 21,952. The longest net, of 10,000 feet, was taken by deputies William Armstrong and C. F. England.

Deputies S. H. Lyons and Frank E. Dunne, Santa Barbara County, on reliable information furnished early in September that H. W. Waldbillig had killed a deer before the season, secured a conviction and a fine of $100.

On December 8, 1927, volunteer deputies Louis Cardinalli and R. M. Grose were tempted to try a "special dinner" at the Commission Cafe in San Francisco when told by the waiter that the special feature of the meal comprised "wild sprig duck." Later, on December 17, the operators of the cafe found themselves before Judge J. M. Golden, who imposed a fine of $200.

Allotment blanks listing numbers of fish desired and kinds preferred for planting the net work of streams and lake bodies of California have been filled out by captains and unattached deputies and returned to Captain O. P. Brownlow. Care has been exercised in most cases in the composition of these allotments to avoid exaggerated needs. There are about fifty counties having streams and lakes in which fish are planted and consideration must be had for a fair and equal distribution. The supply of fish forthcoming from the hatcheries is not sufficiently abundant to allow overstocking.

Department of Fish Culture

The number of trout eggs taken during the fall spawn totals well over eleven millions. By species these eggs taken at egg collecting stations from wild trout in racks or traps, and at hatcheries from brood fish are as follows: Eastern brook, 3,375,500; brown trout, 2,434,000; and Loch Leven, 5,558,000. These figures also include eggs recently purchased in the east.

The spawning season at the Mount Shasta Hatchery is over and the spawning crew, so active in sorting the trout to size and sex, in cleaning the ponds and transferring the trout to various pools, are turning to other duties. Some of the eggs of the first spawners have been hatched and so far the loss during the hatching period has been below normal. It is believed that this is due to the excellent condition of the trout at the time they were spawned.

During December, 1,945,000 Loch Leven, 595,000 German brown and 304,000 eastern brook trout eggs were taken, while a total of 128,000 eggs were secured during the month of January. In addition to these eggs, 750,000 eastern brook eggs have been secured from Cresco, Pennsylvania, and 50,000 of the same variety from Massachusetts. These several lots of eggs are being distributed to the various hatcheries throughout the state.

The 3,251,000 Quinnat salmon eggs at the Fall Creek Hatchery are in excellent condition. Already the first lot of eggs taken are hatched and the balance are developing.

During the winter the Klamath River stations were placed in readiness for the spring run of trout. At some stations new concrete piers, racks, holding tanks and traps have been constructed, and at all stations equipment has been repaired. The run was late this year, since the seasonal rainfall and snowfall, with the exception of San Diego County, was below normal.

Some 950,000 eastern brook trout eggs taken at Gull Lake during the fall spawn-

ing are in the process of hatching at the Mount Whitney Hatchery. During January, 100,000 of these eggs were shipped to the Mount Shasta Hatchery and 200,000 to the Burney Creek Hatchery in Shasta County.

A storm the latter part of November caused the water in Prairie Creek to rise to such a height as to wash out the racks. As a result of this new racks have been built fourteen feet long and placed in the main channel and the old racks placed in the newly created stream channel; hence the station is now in condition to cope with heavy floods.

The first steelhead and cutthroat trout taken at the Prairie Creek Station proved to be too green for spawning and the crew was forced to prepare a place to hold them. By placing a set of low racks below those in the new channel a suitable pond was made which will serve a similar purpose in the future.

Thirty more troughs have been added to the original eight at this station. Several million steelhead trout eggs can be eyed now and sufficient number of eggs hatched to meet local demands if Prairie Creek enjoys this year the good runs that have attended it in the past.

The channel from the spring to the hatchery at Bear Lake has been cleaned out and the sides of the stream walled up with rock to prevent the water washing the banks. This will insure a cleaner water supply for the hatchery and be a great aid when the hatchery season is at its height. The winter has been mild at Bear Lake, but the permanent traps are in place in the event a good fall of snow makes assurance of an increased water supply.

The Loch Leven trout in holding tanks at the Yosemite Hatchery have had a difficult time clinging to life during the winter on account of the considerable amount of ice formed in the tanks. An investigation by the biologist of the department showed the water was so cold that the fish were not eating as they should and sour stomachs caused them to develop internal bacterial infection.

Hatchery operations at this hatchery have started for the season with a shipment of 100,000 Loch Leven and 100,000 eastern brook eggs from the Mount Shasta Hatchery.

The experimental hatchery at Mormon Creek has been completed and an experienced fishculturalist, F. A. Hamor, placed in charge. It was necessary to fence the premises to keep stock from interfering with the hatchery water supply and to build ditches and levees to turn away the surplus water and keep the ponds uncontaminated. Attention to other details has rendered the site habitable and convenient for the season's operations.

In December Loch Leven eggs were shipped from the Mount Shasta Hatchery to the number of 300,000. In January, 50,000 more Loch Leven eggs were placed in the hatchery troughs and 100,000 brown trout eggs.

It is planned to open the Tallac Hatchery earlier than usual this season in order to receive a larger shipment of rainbow trout eggs so that the resulting fry can be removed to the fly-casting club nurseries on the Truckee River.

The Lake Tahoe Hatchery has 200,000 Loch Leven and 380,000 eastern brook eggs in the process of hatching. Of the eastern brook eggs 80,000 were supplied from a take at Marlette Lake, Nevada.

The Department of Architecture is rushing the work on the new Kaweah Hatchery building, with the object in view of having the hatchery in shape to receive the eggs from spring spawners. For preparedness sake, in case the new building is not completed, the old troughs are being placed under a temporary shed.

It is planned to stock the streams and lakes in Sequoia National Park and the surrounding high Sierra as well as the streams in the Tule River drainage basin from this hatchery.

Two hundred thousand eastern brook eggs were placed in the troughs at the Kern River Hatchery on January 17. These eggs were received from the Paradise Brook Trout Company at Cresco, Pennsylvania.

The Loch Leven eggs from the Mount Shasta Hatchery are hatching slowly, due to the extreme coldness of the water.

The water in Lake Pillsbury is very low and a storm of thirty-six hours duration is necessary to cause the water to flow over the spillway of the Snow Mountain Water and Power Company. Repairs, however, have been made at the Snow Mountain Egg Collecting Station and everything is in readiness for the steelhead run. If a rainstorm does not raise the waters of the lake, little hope is entertained that the power company can be

induced to allow sufficient water to escape to bring the fish up to the egg-collecting station.

Bureau of Education

The Bureau of Education has received a legacy of historical value. An exhibition case from California's first museum of natural history—Woodward's Gardens, San Francisco—has been donated by the Golden Gate Park Museum, together with a fine series of mounted specimens of birds and mammals. Some of the specimens were promptly used at the Cloverdale Citrus Show where an exhibit was installed. Mounted specimens, as well as study skins, are now available for school use as a result of this donation.

Reports of damage to deciduous fruit trees as a result of bird-cutting activities of linnets and other birds have been investigated and means are being devised to solve this economic problem. In eastern Tulare County the damage is real and the rancher needs some means of protecting his crop against depredations by birds.

The lecture program has increased to such an extent that the attendance record for the past few months shows an average of about 10,000 persons per month.

Bureau of Research

Reports of duck sickness on Buena Vista Lake led to an investigation. Chemical analyses were made of the water, birds were examined for blood and other parasites and an earnest endeavor made to locate the cause. Efforts made to salvage sick ducks were successful, nearly a thousand birds having been liberated after recovery.

Numerous miscellaneous autopsies have been performed, including a study of three quail apparently poisoned in Berkeley and two quail from Catalina Island which disclosed no reason for their death.

Parasitologist O'Roke has been gathering data on normal conditions in ducks and quail. A series of blood slides has been prepared and a number of internal parasites isolated. A study of the literature relating to animal disease is being made.

Bureau of Game Farms

The first pheasant egg was laid on the morning of February 24. This event was heralded as a token of spring's arrival.

The winter season has been devoted largely to preparations for the approaching hatching period at the Game Farm. New breeding pens have been erected, a few decidedly larger than any heretofore used. The ground in the pens has been seeded to suitable cover crops which are now well up and in flourishing condition. The work of picking the breeding stock has been completed, and, by a process of eliminating the less fit, some 800 Chinese ring-necked pheasants have been selected. One hundred and fifty more bantams and their crosses have been hatched in order to increase the stock of this class of birds and to facilitate propagation of greater numbers of pheasants.

Among the latest additions to the Game Farm are nine wild turkeys—seven hens and two toms. These noble birds have been brought from Arizona and are a loan of Mr. George O'Connor. Half of each year's increase is to remain the property of the state and it is anticipated that this arrangement will at least furnish the basis for operations to stock suitable covers with this famous American game bird.

For the purpose of introducing new blood and virility into the brood stock, an exchange of twenty-four male ring-necked pheasants has been effected with another game farm.

Three male versicolor pheasants have also been secured for the purpose of obtaining a cross between this variety of pheasant and the ringneck. Many game breeders consider this cross advantageous, claiming that the new strain produces birds more alert and swift of wing. It is expected to secure about 600 eggs from the three breeding pens in which the three versicolor males will be placed.

Negotiations have been under way with the end in view of making a further exchange of birds wanted by the San Diego Zoological Society for other game birds desired for propagation studies at the Game Farm.

The equipment specially designed to properly handle and propagate the new lot of Hungarian partridges has been productive of good results. Construction work on the pens was rushed during the winter and results so far indicate that

this effort was well spent. The pens are equipped with trap doors operated in such a manner that the attendant can segregate a pair of birds that have left the flock and Already on February 17, a pair showing every evidence to begin the season's work was placed in one of the new breeding pens.

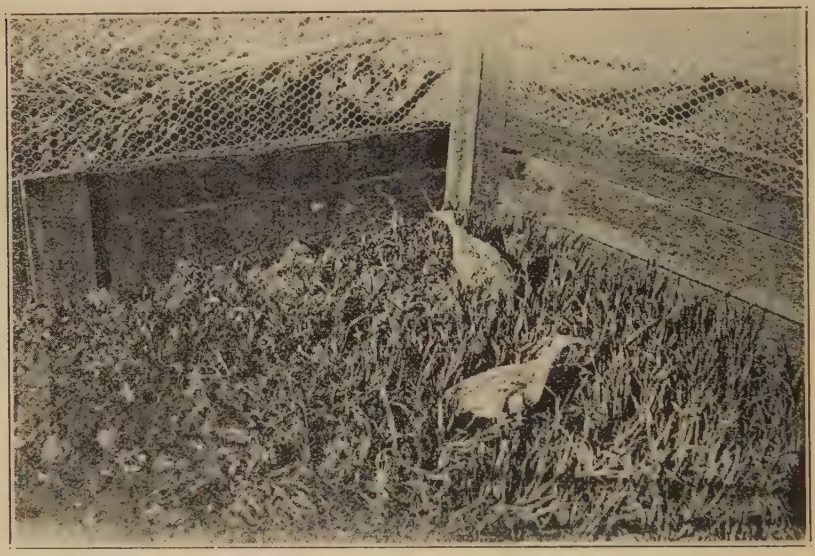

FIG. 46. Tinamous, new birds from South America which will form the basis of breeding experiments at the Yountville Game Farm. February, 1928.

FIG. 47. Arizona wild turkeys, new arrivals at the Yountville Game Farm. February, 1928.

mated. This arrangement is necessary since the Hungarian partridge persists in selecting its own mate and because it is impossible to mate the bird artificially.

The 1928 season commenced with the following birds on hand: 1391 ring-necked pheasants, 29 silver pheasants, 33 golden pheasants, 10 Reeves and 2 Lady Amherst

pheasants; 3 versicolor pheasants; 125 Hungarian partridges; 10 tinamous; 49 Chinese bamboo quail; 121 California valley and 4 mountain quail; 1 grouse; 20 mallard ducks; 12 peafowl; and 9 wild turkeys.

Bureau of Public Relations

The Bureau of Public Relations during the past months has been engaged in the preparing of timely publicity stories, establishing of contacts with newspaper publishers and organizations, and on a few occasions addressing meetings of service and other clubs.

The function of this bureau is to promote better relations for our Division through the media explained above. Through a large acquaintanceship with newspaper publishers, editors and reporters, and with the knowledge that our message is of vital importance, it has been possible to secure valuable publicity for the various activities of the division not only in the smaller papers, but in the metropolitan areas: San Francisco, Oakland, Los Angeles, San Diego, Fresno, Sacramento, San Jose and Santa Barbara.

At times it is necessary to develop news stories which are of only immediate interest. When this condition arises, the stories are released through the three press associations which have headquarters in San Francisco: the Associated Press, United Press and International News Service.

The Service Bulletin, personnel organ of the division, is one of the products of this bureau. This monthly bulletin is prepared from reports of field men and bureau heads, and contains valuable information of importance to those who receive it.

The success of the work of the department depends upon the cooperation of the various bureaus where information is sought and the men in the field who can aid by making full and complete reports of unusual or sensational incidents that may occur, either when some violator is arrested, prosecuted and fined or when an extraordinary situation arises.

Bureau of Hydraulics

Suits against ten more of the Huntington Beach operators have been dismissed, as a survey of their properties showed determined efforts on their part to check pollution. These companies have further made assurance that they will continue to safeguard against the evil.

Legal action has been started against six companies operating in the Long Beach field, where conditions have become so bad as to warrant this step. Many of the Long Beach companies are members of the Oil Operators, Inc., and are, accordingly, in a position to run their waste oil into a pipe connecting with the sump put in a year ago. The six companies served with summons, however, have permitted the oil to escape into natural drainage, where, in the course of time, it finds its way to the beach and ocean.

Allowing waste oil to escape into the Ventura River was a costly negligence on the part of two companies operating in that field, where fines of $200 apiece were imposed. Noting oil on the river, Deputy Walter Emerick traced the source of the pollution to the McKeon Drilling Corporation and the Bolsa Chica Oil Company. Judge Henderson of Ventura imposed a fine of $200 for each offense, but suspended half of the penalty, warning the latter company that a recurrence of the offense would necessitate paying the full fine.

The Associated Oil Company, operating a refinery at Avon, has joined the ranks of those who have stopped oil pollution, or are approaching it.

An inspection of the southern California oil fields reveals that a new oil field is being opened on the seashore at Rincon. No evidence of pollution has come to light so far.

It is a pleasure to know that the California Petroleum Company has put its properties in such shape as to minimize pollution in the Huntington Beach and Long Beach oil fields. The Standard Oil Company has completed a waste water line to the ocean, thus entirely eliminating pollution from this source.

United States Army engineers have repaired and altered the fish ladder at the Daguerre Cut Dam on the Yuba River, twelve miles northeast of Marysville.

A fish screen of parallel bars has been installed by the Hallwood Irrigation Company and the Cordura Irrigation District on this jointly owned ditch which diverts water from the Yuba River at Daguerre Cut Dam.

The Mendocino Lumber Company has completed the construction of a fish ladder on the North Fork of Big River, Mendocino County. This will open the upper regions to the spawning salmon and steelhead.

The Cascade Land Company has completed a fish ladder on San Anselmo Creek, Marin County.

The Eastbrook Dam on the Trinity River, in Trinity County, now no longer offers obstruction to migrating fish, as some portions have been removed.

The Union Oil Company at San Luis Obispo has continued the removal of oil from the creek and beach caused by a fire in the early part of 1926. All traces can not be removed and it is expected that signs of oil will appear for some time to come. Nevertheless, the work done will greatly lessen the deleterious effects on fish and plant life which the oil would have caused had it remained.

Fish ladders have been constructed, replaced or repaired on the Gardella Dam, Trinity County; Madonna Dam, San Luis Obispo County, and the Black Dam, Santa Clara County.

FIG. 48. Mormon Creek experimental hatchery, near Sonoma, Tuloumne County. One of the newest hatcheries. Photograph by Fred Leighton, February, 1928.

COMMERCIAL FISHERY NOTES

N. B. SCOFIELD, Editor.

UNTANGLING THE NAMES OF FISHES

When is a herring not a herring? The answer to this one is simple; when it is a queenfish. The reason for this flat joke is that along the southern California coast a small member of the croaker family, the queenfish, is caught and much of the time called (especially by sport fishermen) a "herring." Since this fish does not in any way resemble a herring, which is a member of the same family as the sardine, this misnaming makes a confusion of terms.

Unfortunately, we have many such common name tangles among our salt water fishes in this state. Most of these have come about by people labeling a fish with a name that belongs to some other species with which they are familiar and imagine it resembles. Also, fishermen and dealers sometimes like to call local fish by the names of fish which have excellent reputations for food qualities elsewhere, thus making it easier to sell the species in question on the reputation of another. Then some of our fish are wrongly labeled for no good reason at all.

One of the worst of these confusions is the "bluefish" caught chiefly around Monterey. This is a species of rock fish and, probably because it has a blue tint

in its coloration, is called "bluefish." The distressing part of this is that on the Atlantic coast there is a true bluefish, a fish justly famous for its gastronomic and sporting qualities. These fish do not resemble each other any more than do booby owls and mallards, and the eastern bluefish certainly would not feel flattered by having its name tacked onto our rock fish. Just to make matters a little worse, there is a croaker which is occasionally taken in southern California, which is also called "California bluefish."

Another perplexity is the young white sea bass, which is called "sea trout." It is not a relative of a trout and, besides, there is no sense in having a fish start out a trout and end up a bass. Incidentally, the white sea bass is not a bass, but a croaker. A member of the Hexagramidae family, common around San Francisco, is also called "sea trout." The only resemblance it bears to a trout is that it has spots—but so has a setter pup.

Besides these cases, we have the southern halibut, which is a flounder; several so-called soles, all of which are flounders; a rock fish called a "salmon grouper" and several more tangles of names. Therefore, it is wise to look with skepticism upon any individual who catches a fish out of the Pacific Ocean and says, "I know what it is. I used to catch the same fish out of a creek back in Nebraska." However, by means of the knowledge of local names that the Department of Commercial Fisheries has collected, the catches of the various species are correctly tabulated and published. Also, it is hoped that the bulletin which the laboratory plans to publish within the next year, showing photographs and accepted common names of all our commercial fishes, will help to standardize the correct names.—J. A. Craig, State Fisheries Laboratory.

FISH CANNERS ORGANIZE

The resignation of B. D. Marx Greene as attorney for the Commercial Fisheries Department became effective March 1, 1928. Mr. Greene has held this position since resigning as executive officer. In addition to resuming his private practice, Mr. Greene will act as attorney for the Monterey Sardine Canners Association and other canners in southern California. These concerns have retained him in a movement which it is hoped will lead to an organization of the entire industry upon a more profitable basis. His investigation will have as its objective the working out of a system which will mean an export corporation under the Webb Law and, among other things, a closer cooperation with the Fish and Game Commission along law enforcement, legislative and constructive lines.

Mr. I. Zellerbach, president of the Fish and Game Commission, commented on Mr. Greene's resignation as follows: "Mr. Greene has served the Commission faithfully and efficiently for four years. During two of these years he held three combined positions—executive officer, attorney for the Commission and attorney for the Commercial Fisheries. It pleases me greatly to learn that he has accepted a retainer to make this extensive survey for what promises to be a real organization of fish canners.

"Had such an organization been formed years ago in this great industry, many bitter legal battles would have been avoided. I understand this will mean a much closer cooperation with the Fish and Game Commission, and this attitude on the part of the canners is one which I have urged ever since becoming a member of the Fish and Game Commission. It appears that a new day has dawned for the packers and the Commission."

LIFE HISTORY NOTES

A PLEA FOR THE WHITE-TAILED KITE

One of our most beautiful birds that is nearing extinction in California is the white-tailed kite, *Elanus leucurus*. This bird is most apt to be met with flying over swamps or marshy river bottoms, and can be recognized by its white tail, black shoulders, and its silvery wings and light underparts. It is the size of a small gull and has the habit of slowly flying back and forth over damp ground, hovering at times almost stationary with beating wings just before dropping upon its prey. Small rodents, such as mice and shrews, with insects, compose the greater part of its food. Thus it is of economic value to the farmer besides adding a touch of wonderful beauty to the landscape.

To anyone who has seen this bird in flight, especially when it is going through these falling and hovering antics, which it accomplishes with utmost grace, there is a charm supreme.

The kite's note is a soft whistle with an occasional low cackle and is heard most often when one is near its nest. It is also at this season that the bird gives its best demonstration of turning, tumbling and diving through the air, an exhibition of rare charm and beauty that will never be forgotten by one who has witnessed it.

One must not forget that the kite is a rare bird in California and that it is protected at all times by our laws; even scientific collectors are forbidden to harm the bird or molest its nest.

Those hunters who frequent marshes, swamps or river bottoms should be very careful not to shoot this small gull-like hawk. It is not a destroyer of game birds and harms not your sport in the least. Leave them alone, as there are all too few left and they must not go the way of our passenger pigeons and buffalo.

Let these harmless creatures remain so that their beauty can add its charm to our already beautiful California landscape.—Wright M. Pierce, Claremont, California, January 6, 1928.

FIG. 49. White-tailed kite from a mounted specimen. Courtesy of San Diego Society of Natural History.

MISLEADING NAMES IN VARIOUS COMMON BIRDS

Quite often there are questions forthcoming by people in the field with regard to birds with descriptive names that do not match their actual plumage coloration, as we see it.

Some of these are as follows:

Red-tailed hawk.
Black-bellied plover.
Spotted sandpiper.
Red-backed sandpiper.
Red phalarope.

The red-tailed hawk does not acquire its russet tail until it is several years old. The tail previous to that time is barred with gray and black.

The black-bellied plover is a bird which changes its plumage in the fall to a modest dark gray flecked with white on the back. It is entirely white below except for brownish flecking on the throat and breast. In spring and summer the entire underparts are solid black, with a white border over the forehead and down the sides of the neck. Since we see this bird mostly in fall and winter, we are not familiar with the black-bellied plumage. Some birds are in the process of changing to summer plumage before they leave this latitude in the spring.

The spotted sandpiper also changes to a considerable extent in spring and fall. If one goes to the Sierra Nevada Mountains in summer they will see this bird in its breeding plumage with its white belly and throat, spotted with large, round, black spots and grayish, black flecked back. In the winter this bird is white beneath and grayish above, with a few fine brownish lines on the back feathers.

The red-backed sandpiper is another bird which has entirely different plumages for summer and winter. In spring and summer the top of the head and the back are a bright chestnut brown with black streaks on the back. The throat and breast are white, streaked with dusky and a black patch on the belly. The rest of the underparts are white. In the fall and winter, the upper parts are ashy gray, underparts mostly white with brownish band across the breast. We see but very few birds in the spring and summer plumage.

The red phalarope in spring and summer has the top of its head black, with the sides of the head white. The upper-

parts are buffy brown streaked with black. Underparts are entirely deep chestnut. The bill is yellow with a dusky tip; feet yellowish. In winter the forehead is white, back bluish gray with but few streaks. The underparts are pure white. The bill is black with yellowish base. Feet bluish gray.

This will, I hope, help to clear up some of the identification troubles of some of the deputies and people working in the field. Shorebirds are hard enough to identify without their going through a complete change of plumage in spring and fall. Many hawks and gulls do not acquire their adult plumage until after several years in the immature plumages and intermediate stages have been gone through.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.

FIG. 50. White-tailed kite in flight. Copyrighted photograph by Wright M. Pierce.

THE PIGEON HAWK'S BILL OF FARE

Although the northern pigeon hawk (*Falco columbarius*) is never common in California, it might be well to note some of its food habits during its stay with us during the winter months. Most of my experience with this species has been in the lower edge of the yellow pine belt (Transition life zone) of the Sierra Nevada Mountains.

During the winter months, the pigeon hawk is rather locally distributed.

Of the nine specimens I have taken, eight have come from the same locality in Mariposa County. The ninth was taken between Hollister and Gilroy, in San Benito County.

Its favorite prey seems to be shorebirds, robins, pipits and Savannah sparrows, while that of the sparrow hawk is almost entirely insects.

A female bird, taken in Mariposa County, had eaten a junco and a pipit with the remains of two other pipits in

Fig. 51. White-tailed kite hovering in air. Copyrighted photograph by Wright M. Pierce.

In flight, this species shows the same dash and spirit as does the duck hawk, but is so small that it is not capable of coping with such large prey. The bird is only slightly larger than the sparrow hawk.

The food of this species is a noticeable contrast to that of the sparrow hawk. the stomach which were nearly digested. An immature male from near the same place had eaten a robin and could scarcely fly, due to the added weight. Still another immature bird had parts of a robin and had a meadowlark in its stomach. The meadowlark was nearly digested. An adult male was eating a

robin when shot and another had just killed a red-shafted flicker. Another adult male had a California jay in its possession, while another had eaten a robin. A young male bird that seemed droopy had eaten a junco, a pipit and an unidentified bird, presumably an Audubon warbler. The one collected near Gilroy had eaten four Savannah sparrows.

All of their food seems to be plucked to a considerable extent, but none of the flesh is discarded unless possibly some of the entrails. Wings, feet and bills were found in the stomachs.

Birds are generally knocked down in a cloud of feathers, then picked up and carried away to be eaten in some secluded spot.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.

brant, *Branta nigricans*. At times several hundred birds were present.

The brant has not been present on the bay for a number of years, due, probably to the fact, that the increased habitation and consequent building on Mission Beach strand, separating the bay from the ocean, has frightened the bird. It is hoped it will become accustomed to the improvements and continue to make this bay its habitat during the winter months, as in former years.

The brant has been observed also in large numbers on San Quentin and Magdalena bays to the southward.—Ad B. Pearson, San Diego, California.

A NOTE ON THE FOOD OF THE LONG-BILLED CURLEW

On examining the stomach and gullet of a long-billed curlew, sent in for preparation into a study specimen, I discovered seven large sand fleas (*Orchestoidea californiana?*). Several of them were in the gullet and the remainder were in the stomach in varying stages of decomposition, due to the process of digestion in the curlew. No other species was found in the digestive tract.

The bird was taken on Morro Beach, San Luis Obispo County, California, January 20, 1928.—D. D. McLean, 711 Postal Telegraph Bldg., San Francisco.

FIG. 52. Large wildcat taken near Verdi, Nevada, by S. M. Wiley. Weight nearly 60 pounds.

UNUSUALLY LARGE WILD CAT CAPTURED

In September, 1927, I trapped a very large wildcat near Verdi, on the California-Nevada line. It weighed nearly sixty pounds and the skin stretched on a board measured five feet. It was the finest pelt I ever saw. The accompanying photograph gives a good idea of its large size and perfect spotting.—S. M. Wiley, Verdi, Nevada.

BLACK SEA BRANT ON MISSION BAY

In addition to pintail and widgeon ducks being more abundant this year than for several years past on Mission Bay, four miles north of San Diego Bay, we have seen several flocks of black sea

NOTES ON A CAPTIVE TURKEY VULTURE

On January 10, 1928, a turkey vulture (*Cathartes aura septentrionalis*) was brought to me. It had been shot through the right wing, but the bones were not

broken, and it seemed to be otherwise uninjured, except for the loss of the right foot, an injury of long standing, since the stump of the tarsus was healed and enlarged on the end from being used in place of the missing foot. It appeared to be an immature bird from the absence of red skin about the head. I put it in the stable for the night and the next day made a pen of chicken netting in a corner of the upper floor of the barn, where it would get the sun in the afternoon. I got some beef liver for it, but it paid no attention to this food, which remained in the pen and dried up, and was not eaten at all.

The bird had nothing to eat until January 13, when a mouse and a pocket gopher were given it, and the mouse was gone about an hour later and the gopher was eaten the next day. From then until February 2, the bird ate one pocket gopher a day. On January 18, I put band No. 421544 on the bird and turned it loose, but it could not fly, so I put it back in the pen. On January 21, Mr. James A. Calder took some pictures of it, and it was still unable to fly.

Being anxious to see how a vulture with only one foot could hold a gopher to tear it, I put up a blind of canvas about eight feet from the center of the pen, and on January 24, at 2.47 p.m., I put a gopher, that had been dead twenty-four hours, in the pen, and retired behind the canvas to watch developments. The vulture stood in the far corner of the pen for several minutes without moving, then started preening its feathers and shaking itself and eyeing the gopher. At 2.56 it came over to the gopher, nibbled at it, picked it up by a leg and dropped it several times, then left it and spent several minutes trying to get out of the pen. At 3 it was back in the corner preening its back and breast feathers. Standing on the one foot, only using the stump when moving about, at 3.03, ran a primary covert through the beak, twice, turned head on side and looked up at the roof several times, as if expecting others of its kind to come to the feast, and at 3.05 yawned. At 3.10 stood with feathers fluffed out, occasionally preening feathers of lower back or breast, seemed suspicious of movements of the canvas caused by the wind. It stood almost motionless until 3.16 when I left the blind. I was nearby until 3.43, when I left the barn and did not return until 5.05; by that time the gopher was gone except for the head and the stomach.

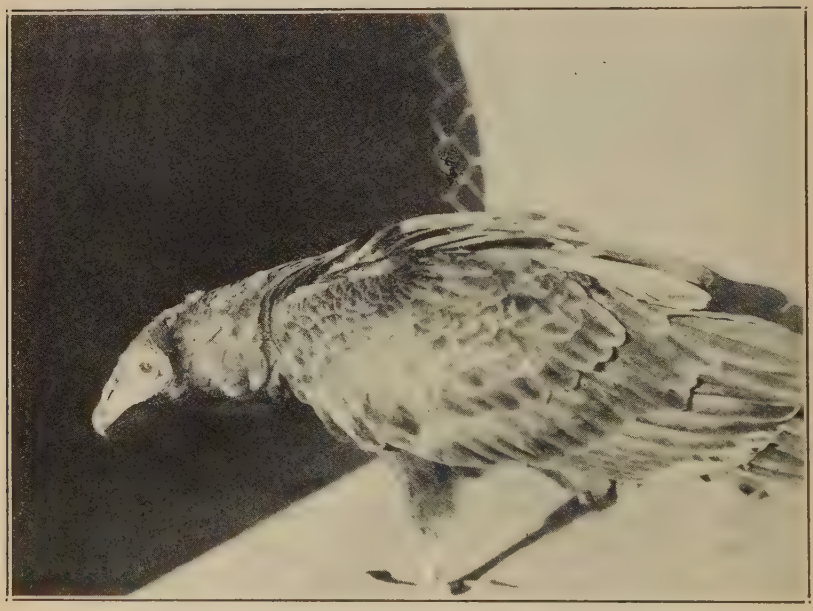

FIG. 53. Captive one-legged turkey vulture. Photograph by J. A. Calder.

On January 25, at 2.50 p.m., I put a gopher in the pen and went into the blind. The vulture moved to the sunny side of the pen, stood on its one foot with the stump drawn up close to its body, peering around suspiciously, preening, and once rubbing its head on its back. At 2.57 it approached the gopher,

picked it up by a leg and dropped it, several times, and nibbled at it, and then, trying several times to hold it with the stump, hopped about until the claw of the long middle toe of the left foot held the gopher down, and then tore it open, starting just back of the ribs, on the side. The intestines and all the other organs were eaten, except the stomach, which was pulled out and dropped to one side. Still holding the carcass with the middle toe, pieces were torn off and swallowed, bones and all; then the hind quarters were torn from the rest of the body, and both hind legs, the tail and part of the spine were swallowed in one chunk with much gulping and straining. A large piece of skin from the back was discarded, and, then, trying to hold it down with the stump, but being unsuccessful and resorting to the middle toe again, the fore part of the body was torn off and swallowed in small bits until at 3.10 only the skull and the skin on top of it remained. Then the bird turned its attention to the discarded piece of skin and ate most of it; then the stomach was torn apart and eaten, only part of the contents, a mass of green vegetable matter being discarded. At 3.19 the vulture retired to the corner of the pen, the meal finished.

This was a small gopher, and with some larger ones more skin and some bones besides the skull were left; in several cases the front legs were pulled back through the skin and the bones picked clean, and in some cases the skull was skinned out and picked clean, the lower jaw being torn loose from the skull. With one extra large gopher several inches of the spine was left attached to the skull. Pellets were ejected which were composed almost entirely of fur, only small fragments of bone were found in some of them. A can of water was kept in the pen, but I saw no evidence that the bird drank any of it.

On January 31, the vulture was out of the pen and roosting on a timber over the open barn door, and was put back in the pen, and on February 2, when I got back from work, it was gone and has not been seen since. It shed many white, downy feathers, and several flight feathers while in captivity. When our dog came near the pen, it usually made a loud hissing sound, if I was not in sight, but was silent when I was nearby. It did not require its food to be ripe, as it sometimes ate gophers before the blood heat was out of them.—John McB. Robertson, Buena Park, California.

MUSKRATS AND BEAVER IN IMPERIAL COUNTY

A recent investigation of the activities of trappers in the southeastern portion of Imperial County disclosed a considerable number of operators. In the main, the catches comprise muskrat, fox, skunk and coyote. Of these the muskrat appears to be preferred. One trapper told us he had caught 130 muskrats in nine days along the banks of the Imperial Valley levee. As the muskrats were much easier to skin and handle than any other fur animal, their popularity with the trappers is obvious. This trapper stated he could skin ten "rats" to one coyote.

The majority of the muskrats are caught in the tules bordering the canals of the Imperial Valley proper. A number are also trapped around the potholes near the Colorado River. These potholes are formed by the receding waters of the river and are sometimes miniature lakes, being a mile in length and one-half mile in width. The water in these lakelets offers a decided contrast to the muddy appearance of the turbulent river and is quite clear and placid. Willows and cottonwoods grow in abundance about their margins and offer attractive food for colonies of beaver. Most of them exhibit "beaver sign" by the numbers of trees felled into the water. Beaver "slides"—avenues in and out the lakelets—are other evidence of their presence. As a rule, the trappers set their traps in these places.

Happily, beaver appear to be on the increase. This is no doubt due to the closed season and the resulting protection afforded. The Arizona season, too, has been closed for a number of years, but at the time it was open it was common practice for Arizona trappers to cross the river at night and return before morning with a few California beaver. The state of Arizona employs two wardens to patrol the Arizona side of the Colorado and protect these beaver.—E. H. Glidden, San Diego, January, 1927.

CONSERVATION IN OTHER STATES

NEW YORK INTRODUCES VARYING HARES

Like many an eastern state, New York has been lamenting the disappearance of rabbits. As a consequence, the Department of Conservation recently purchased 700 pairs from Maine. These were all wild hares trapped in their native haunts. After holding the shipment so that the animals might be examined for traces of disease, they were liberated in suitable covers, particularly in the Adirondacks in brush marshes and ravines. There is a chance to reestablish this game mammal. Some seven counties were thus stocked.

NEW YORK PLANS SERIES OF REFUGES

Recently the state of New York provided for funds to be used in the acquiring of more agriculture areas for establishing fish and game refuges. It has been found that one-half the moneys received from the sale of licenses would amount to about $350,000 per year. The Department of Conservation is now starting out on a program to furnish a fish and game refuge in every county of the state that is suitable for one. The plan includes the placing of these refuges in such situations that every hunting ground in the state will be benefited by the overflow from the refuges. The first refuge of more than 3800 acres has been purchased. Other proposals are being considered.

NEW YORK SUCCEEDS IN STOCKING AREA WITH MALLARDS

Several years ago the New York Game Farm at Sherburne secured a setting of mallard eggs. From year to year, the breeding stock has been increased and at the same time the surplus have been liberated. Now for miles surrounding the game farm, mallard ducks are permanent residents. For thirty to forty miles both up and down the river which borders the game farm may be found mallard ducks which are the direct descendants of those propagated on the game farm.

NOVA SCOTIA CREATES SANCTUARY

A splendid stretch of 200 square miles of virgin territory, including numerous lakes and streams, has been set aside as a game sanctuary in Nova Scotia. There are natural boundaries which are well defined. The sanctuary is particularly adapted to the conservation of game as it forms a natural breeding ground already inhabited by a large number of game animals. It will be easy to administer as it is far removed from settlements and from territory ordinarily used by the hunter and trapper.

YELLOWSTONE ELK THRIVE IN CANADA

According to an article by Hoyes Lloyd appearing in the *Canadian Field Naturalist* (September, 1927), the Canadian National Parks branch has stocked various areas in Canada with Yellowstone elk which were furnished by the United States Department of Agriculture. In exchange Canada furnished mountain goat and sheep. One of the first introductions was that of sixty-three elk, yearlings and two-year-olds, which were shipped to Banff on February 20, 1917. Later in December, 1919, another shipment of 194 was made. The animals have increased and have spread widely over the entire park.

A shipment of nearly 100 elk was sent to Jaspar National Park in British Columbia on March 13, 1920. This herd has increased rapidly and a census in 1926 showed about 1200 head in the park. They are now found in practically every valley.

Active interest in saving the buffalo brought worthwhile results and it appears that the North American elk can be handled as successfully.

There yet remains the successful solution of California's elk problem. Cut down to some 400 head of wild animals at the lower end of the San Joaquin Valley, there is needed at least two well fenced areas where these remaining animals can find a suitable food supply and where they can be kept for enjoyment of future generations. Depredations in cultivated fields continue to warn conservationists of the need for early action in this regard.

REARING vs. PURCHASING GAME

Mr. H. J. Burlington, president of the New Jersey Board of Game and Fish Commissioners, concerning the wisdom of operating state-owned game farms as against purchasing game in the open market, stated that the cost of rearing ring-neck pheasants in his state has been brought down to $2.28 per bird, and they hope to do considerably better. Last year they reared 8000 ringnecks and purchased 10,000 birds in the open market. They also distributed about 40,000 eggs to interested sportsmen and farmers for hatching purposes. New Jersey has found it unwise to release ringnecks before they are fourteen weeks old.

REPORTS

STATEMENT OF EXPENDITURES

For the Period October 1, 1927, to December 31, 1927, of the Seventy-ninth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	$1 92	$4,215 00	$458 25	$8 75	$4,683 92
Clerical and office	169 64	4,039 75	466 00	18 15	4,693 54
Rent			2,960 81		2,960 81
Automobiles	94 12		167 72	13 80	275 64
Telephone and telegraph			1,443 34		1,443 34
Postage			765 78		765 78
Freight, cartage and express			452 86		452 86
Printing	4,155 80				4,155 80
Accident and death claims			280 06		280 06
Commissioners			345 11		345 11
Total administration	$4,421 48	$8,254 75	$7,339 93	$40 70	$20,056 86
Education:					
Director and assistants	$97 55	$3,660 17	$906 34	$3,013 35	$7,677 41
Publicity:					
Director		$825 00	$244 57		$1,069 57
State Fair			50 00		50 00
Total publicity		$825 00	$294 57		$1,119 57
Conservation and protection:					
Chief and assistants		$3,580 03	$803 87	$87 00	$4,470 90
Clerical and office	$17 89	818 67	1 00		837 56
Rent			116 46		116 46
Automobiles	619 77		193 25	44 40	857 42
Captains and deputies	105 83	49,567 27	37,992 95	3,255 52	90,921 57
Patrol launches	400 09	520 00	165 25	602 25	1,687 59
Lion hunting		450 00	187 32		637 32
Lion bounties			1,670 00		1,670 00
Fish planting		665 00	194 94	121 91	981 85
Refuge posting	75 02	495 81	154 67	20 65	746 15
Total conservation and protection	$1,218 60	$56,096 78	$41,479 71	$4,131 73	$102,926 82
Commercial fisheries:					
Chief and assistants	$69 40	$2,410 03	$603 53	$127 95	$3,210 91
Deputies	11 61	7,743 02	2,203 50	43 09	10,001 22
Patrol launches	465 47	1,188 17	773 96	2 76	2,430 36
Statistical	1 25	1,395 00	99 44	150 00	1,645 69
Laboratory	339 97	7,847 58	1,681 77	923 15	10,792 47
Salmon tagging			22 50		22 50
Botulism			3,750 00		3,750 00
Automobiles	217 21		62 55		279 76
Total commercial fisheries	$1,104 91	$20,583 80	$9,197 25	$1,246 95	$32,132 91
Fish culture:					
Chief and assistants		$1,000 03	$19 35		$1,019 38
Clerical and office	$44 24	941 33	6 30		991 87
Rent			108 00		108 00
Automobiles	1,253 07		270 29	$98 92	1,622 28
Hatcheries	6,436 11	29,735 69	4,165 36	6,423 75	46,760 91
Hatcheries, additions and betterments				16,612 51	16,612 51
Special field investigation	6 85	2,775 00	529 97		3,311 82
Total fish culture	$7,740 27	$34,452 05	$5,099 27	$23,135 18	$70,426 77
Hydraulics:					
Chief and assistants	$11 82	$1,305 00	$304 20		$1,621 02
Cooperative research work	99 79	491 67	32 50		623 96
Total hydraulics	$111 61	$1,796 67	$336 70		$2,244 98
Game propagation:					
Automobiles			$6 50		$6 50
Game farm—Yountville	$1,397 09	$2,010 00	1,199 02	$997 28	5,603 39
Total game propagation	$1,397 09	$2,010 00	$1,205 52	$997 28	$5,609 89
Research:					
Chief and assistants	$2 77	$2,362 50	$830 40		$3,195 67
License commissions			$13,619 85		$13,619 85
Total Division of Fish and Game	$16,094 28	$130,041 72	$80,309 54	$32,565 19	$259,010 73

STATEMENT OF INCOME

For the Period October 1, 1927, to December 31, 1927, of the Seventy-ninth Fiscal Year

	Detail	Total
License sales:		
Angling, 1927	$39,156 10	
Angling, 1928	69 00	
Hunting, 1927-1928	99,081 40	
Hunting, 1928	16 00	
Market fishermen's licenses, 1927-1928	5,820 00	
Wholesale fish packers' and shell fish dealers' licenses—1927-1928	215 00	
Game breeders' licenses, 1927	52 50	
Fish breeders' licenses, 1927	5 00	
Trapping licenses, 1927-1928	3,413 00	
Commercial hunting club licenses, 1927-1928	1,185 00	
Commercial hunting club operators' licenses, 1927-1928	350 00	
Deer tag licenses, 1927	73,302 50	
Kelp licenses	10 00	
Total license sales		$222,675 50
Other income:		
Game tag sales	$11 43	
Court fines	20,794 08	
Fish packers' tax	24,706 85	
Kelp tax	1 31	
Fish tag sales	1,037 04	
Miscellaneous sales	20 00	
Interest on bank deposits	738 87	
Total other income		47,309 58
Total income		$269,985 08

SEIZURES OF FISH AND GAME

October, November, December, 1927

Salmon, pounds	128
Barracuda, pounds	9,935
Striped bass, pounds	372
Spot-fin croaker	20
Black bass	15
Trout	348
White fish	2
Crappie	39
Perch	1
Catfish, pounds	90
Crawfish	140
Crabs	301
Clams	1,700
Abalone	145
Lobster, pounds	522
Quail	295
Pheasant	11
Doves	21
Geese	118
Ducks	225
Mudhens	1
Shore birds	49
Non-game birds	57
Deer meat, pounds	1,418
Deer hides and horns	3
Rabbits, cottontail, brush and Sierra hare	59
Hides of fur bearing mammals	22
Illegal nets and traps	4

GAME CASES

October, November, December, 1927

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act	104	$2,240	62
Deer Tag License Act	8	250	
Commercial Gun Club License Act	1		30
Deer: closed season or district	24	1,425	
Deer: does, fawns, spiked bucks, or forked horn in District 1¾	11	675	150
Deer: running with dogs, closed season	1	25	
Deer: illegal sale of meat	1	25	
Ducks: closed season	11	150	115
Ducks: over limit	10	525	
Swan: closed season	4	100	
Geese: over limit	8	200	
Shore birds: closed season	30	785	5
Doves: closed season	10	350	
Quail: closed season	34	1,250	150
Quail: over limit	3	150	
Pheasants: closed season	7	450	
Non-game birds	32	740	
Rabbits: cottontail and brush, closed season	31	760	
Squirrels, tree: closed season	2	50	
Shooting game from automobile, power boat, etc	9	205	
Game refuges: hunting or possession of firearms in	12	275	50
Night hunting	55	1,440	90
Trespass	4	200	
Illegal trapping of birds	1		
Illegal shipping of game	3	75	
Illegal sale of game	4	325	
Fur trapping regulations	11	240	10
Totals	431	$12,910	662

FISH CASES

October, November, December, 1927

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act	23	$570	
Commercial Fishing License Act	9	80	
Trout: over limit	7	100	
Trout: closed season	3	100	
Striped bass: undersize or over limit	23	905	5
Striped bass: sale of, in closed season	2	225	
Salmon: over limit	4	100	
Salmon: closed season or district	2	100	
Salmon: illegal sale of	1	100	
Salmon: illegal taking of on spawning beds	2	50	
Black bass: illegal sale of	1	25	
Crappie: over limit	2	50	180
Barracuda: undersize	3	100	
Crawfish: undersize	2	100	50
Crabs: undersize and females	6	135	
Crabs: closed season	1	20	
Clams: undersize and over limit	43	1,775	60
Abalones: undersize and over limit	37	1,085	5
Lobsters: under or oversize	11	275	10
Illegal fishing: within 300 feet of inlet to lake; 250 feet fishway; 150 feet lower side of dam	1	25	
Illegal fishing: more than one rod or line in trout fishing	1	50	
Nets: illegal possession or use	19	625	
Illegal possession of fish spear	20	600	65
Illegal night fishing	4	75	
Illegal shipping of fish	1	25	
Pollution	3	700	
Totals	231	$7,995	375

SUMMARY OF ANNUAL KILL OF FUR BEARING MAMMALS IN CALIFORNIA—SEASONS 1924-1927

Species	Estimated number			Average price			Estimated value		
	1924–1925	1925–1926	1926–1927	1924–1925	1925–1926	1926–1927	1924–1925	1925–1926	1926–1927
Skunk	29,092	28,107	39,074	$1.265	$1.406	$1.203	$36,721.65	$39,517.29	$47,006.02
Raccoon	11,006	13,358	15,527	3.28	4.392	5.639	36,099.88	58,667.82	87,556.75
Gray fox	8,301	8,878	8,498	1.852	1.928	2.132	15,373.45	17,117.15	18,117.74
Coyote	8,043	8,509	9,631	4.412	4.048	5.07	35,485.72	34,447.52	48,829.17
Wild cat	5,443	6,087	7,015	2.24	2.047	2.242	12,192.32	12,460.52	15,727.63
Civet cat	3,364	4,292	4,839	.476	.68	.656	1,601.26	2,918.37	3,174.38
Beaver		4,019	692		12.366	12.905		49,698.95	9,530.26
Muskrat	3,120	6,207	13,261	.463	.633	.818	1,444.56	3,929.03	10,847.50
Mink	3,066	3,394	4,867	4.635	5.548	7.057	14,310.91	18,829.77	34,346.42
Ringtail cat	2,304	2,698	3,477	2.018	2.414	2.633	4,649.47	6,512.34	9,154.94
Kit fox	1,261	272	2,145	1.949	2.035	2.166	2,457.69	553.52	4,646.07
Marten	1,086	472	479	10.677	11.108	10.485	11,599.70	5,244.97	5,022.32
Badger	457	496	742	1.578	1.723	1.709	720.15	854.61	1,268.08
Opossum	356	613	1,064	.634	1.038	.80	225.70	642.29	851.20
Weasel	338	227	347	.792	.742	.765	267.70	168.43	265.46
Bear	227	292	291	8.50	6.92	8.49	1,929.50	2,018.76	2,470.59
River otter	142	141	158	12.26	13.446	14.456	1,740.92	2,051.01	2,284.05
Fisher	68	30	32	36.784	25.124	42.357	2,501.31	755.61	1,355.42
Mountain lion	65	75	68	15.80	14.071	19.654	1,027.00	1,055.33	1,336.47
Red fox	45	18	23	18.583	14.859	21.50	836.24	268.13	494.50
Wolverine	3			10.00			30.00		
Totals	77,787	88,185	112,230				$181,215.13	$257,711.42	$304,284.97

The above is based on reports furnished by licensed trappers, and is an estimate of the total catch made by licensed commercial trappers. No attempt has been made to include an estimate of the animals trapped by minors under the age of 18 years, or those taken for private use, or those killed in predatory animal control campaigns.

	1924–1925	1925–1926	1926–1927
Number of trapping licenses issued	2,984	3,530	3,790
Number of trappers reporting	1,933	2,338	2,619
Per cent reporting	64.8	66.5	69.1

DEER KILLED IN 1927, BY COUNTIES

County	Deer killed	Land area, square miles
Siskiyou	1,665	6,256
Mendocino	1,475	3,539
Trinity	921	3,096
Lake	901	1,238
Humboldt	821	3,575
Tehama	799	2,925
Monterey	757	3,330
Sonoma	751	1,582
Tulare	744	4,856
Santa Barbara	669	2,740
Glenn	623	1,337
Shasta	612	3,858
Fresno	592	5,950
Plumas	551	2,593
El Dorado	535	1,737
Modoc	510	3,823
Napa	442	783
Los Angeles	425	4,115
Santa Clara	397	1,328
San Luis Obispo	394	3,334
Marin	367	529
Placer	341	1,411
Riverside	323	7,223
Lassen	296	4,531
Ventura	274	1,878
Colusa	263	1,140
Madera	260	2,112
Butte	228	1,698
Alameda	220	732
Kern	218	8,003
San Benito	217	1,392
Tuolumne	213	2,190
Inyo	173	9,991
San Diego	169	4,221
Calaveras	149	1,027
Nevada	125	974
Yolo	115	1,014
Sierra	101	923
Mariposa	95	1,463
Stanislaus	91	1,450
Santa Cruz	78	435
San Mateo	77	447
San Bernardino	74	20,175
Alpine	67	776
Merced	67	1,995
Amador	59	601
Orange	56	795
Yuba	53	632
Solano	45	822
Del Norte	42	1,024
Mono	36	3,030
San Joaquin	21	1,448
Contra Costa	5	714
Kings	3	1,159
Imperial	1	4,089
Sutter	1	608
Sacramento	----------	983
San Francisco	----------	42
Totals	19,507	155,672

To better compare the 1927 kill of deer in the several counties, the following chart shows the average number killed per 100 square miles of area:

County	Average per 100 square miles of area	Deer killed	Land area, square miles
Lake	75	901	1,238
Marin	69	367	529
Napa	57	442	783
Glenn	48	623	1,337
Sonoma	47	751	1,582
Mendocino	42	1,475	3,539
El Dorado	31	535	1,737
Santa Clara	31	397	1,328
Alameda	30	220	732
Trinity	30	921	3,096
Tehama	28	799	2,925
Siskiyou	27	1,665	6,256
Santa Barbara	25	669	2,740
Placer	24	341	1,411
Colusa	23	263	1,140
Monterey	23	757	3,330
Humboldt	23	821	3,575
Plumas	21	551	2,593
Santa Cruz	18	78	435
San Mateo	17	77	447
Butte	17	228	1,698
Shasta	16	612	3,858
San Benito	16	217	1,392
Tulare	15	744	4,856
Ventura	15	274	1,878
Calaveras	15	149	1,027
Modoc	13	510	3,823
Nevada	13	125	974
San Luis Obispo	12	394	3,334
Yolo	11	115	1,014
Sierra	11	101	923
Madera	10	260	2,112
Los Angeles	10	425	4,115
Fresno	10	592	5,950
Tuolumne	10	213	2,190
Amador	10	59	601
Alpine	9	67	776
Yuba	8	53	632
Orange	7	56	795
Lassen	7	296	4,531
Mariposa	7	95	1,463
Stanislaus	6	91	1,450
Solano	6	45	822
Riverside	5	323	7,223
San Diego	4	169	4,221
Del Norte	4	42	1,024
Merced	3	67	1,995
Kern	3	218	8,003
Inyo	2	173	9,991
San Joaquin	1	21	1,448
Mono	1	36	3,030
Contra Costa	1	5	714
San Bernardino	----------	74	20,175
Kings	----------	3	1,159
Sutter	----------	1	608
Imperial	----------	1	4,089
Sacramento	----------	----------	983
San Francisco	----------	----------	42
		19,507	155,672

HUNTERS KILLING TWO DEER.

County of residence of hunter—	
Alameda	112
Alpine	---
Amador	7
Butte	50
Calaveras	8
Colusa	45
Contra Costa	28
Del Norte	6
El Dorado	29
Fresno	66
Glenn	34
Humboldt	96
Imperial	---
Inyo	23
Kern	40
Kings	7
Lake	33
Lassen	8
Los Angeles	166
Madera	13
Marin	43
Mariposa	2
Mendocino	89
Merced	9
Modoc	4
Mono	---
Monterey	72
Napa	34
Nevada	4
Orange	34
Placer	19
Plumas	13
Riverside	25
Sacramento	44
San Benito	23
San Bernardino	18
San Diego	21
San Francisco	100
San Joaquin	42
San Luis Obispo	78
San Mateo	15
Santa Barbara	83
Santa Clara	67
Santa Cruz	20
Shasta	57
Sierra	4
Siskiyou	142
Solano	25
Sonoma	93
Stanislaus	28
Sutter	16
Tehama	45
Trinity	31
Tulare	65
Tuolumne	17
Ventura	28
Yolo	29
Yuba	8
Arizona, State of	1
Nevada, State of	1
Oregon, State of	3
Total	2,223

STATISTICS ON DEER KILL, SEASON 1927

COUNTY OF RESIDENCE OF HUNTER →

COUNTY WHERE DEER WAS KILLED. ↓

	ALAMEDA	ALPINE	AMADOR	BUTTE	CALAVERAS	COLUSA	CONTRA COSTA	DEL NORTE	EL DORADO	FRESNO	GLENN	HUMBOLDT	IMPERIAL	INYO	KERN	KINGS	LAKE	LASSEN	LOS ANGELES	MADERA	MARIN	MARIPOSA	MENDOCINO	MERCED	MODOC	MONO	MONTEREY	NAPA
ALAMEDA	167						12												2									
ALPINE	10	1	1		12										1									1				
AMADOR	5		21		4				1																			1
BUTTE	5			166		1	4				2						1		5									
CALAVERAS	3		11		60		4								1		1		2					1				
COLUSA	3			6		141	7				8						1		3		1		1					4
CONTRA COSTA							4																					
DEL NORTE								38				1							2									
EL DORADO	21	2	31		3	1	6		228						2	2			18					1			5	3
FRESNO	3									377				11	15	20			71	6	1			4			4	
GLENN	31			47		78	3			1	196				2				9	1	5		6	1				4
HUMBOLDT	38					2	15			3	2	501		1	3		2		26	1	16		32	1			1	6
IMPERIAL																			1									
INYO														105	7				50									
KERN														3	134				66									1
KINGS																3												
LAKE	93			4		57	21			2	3	1			3	3	207		12		7		29	1			3	58
LASSEN	8			24		4	8			5	3						3	101	15	1			3		8		2	
LOS ANGELES													1		3				402								1	
MADERA	4									81					1				17	99		8		8			1	
MARIN	15						8								2				1		209							
MARIPOSA	4					2				2						1	1		6	16		32		21				
MENDOCINO	167			3		13	40			2	20	12			4	9	9		32	1	46		494	5			2	18
MERCED	1								1				1						1					42		2		
MODOC	18			20		14	7		1	8	9	9	1		2	12	18	7	25	1	4		5	5	103		4	10
MONO													1	10					7					1		11		
MONTEREY	12						4			9					1	1			31		2			1			436	1
NAPA	18				3		6			2					1		7		1		3		1					226
NEVADA	6						1		1						1				3		1			1			1	1
ORANGE																			3									
PLACER	21				3		13		16				1						2		4						2	18
PLUMAS	28			77		5	5			6	9				1		1	36	42	1	4		2	3				6
RIVERSIDE										1			6	1	1				90									
SACRAMENTO																												
SAN BENITO	4								11							2			6		1			2			16	
SAN BERNARDINO																			18									
SAN DIEGO																			22									
SAN FRANCISCO																												
SAN JOAQUIN	2				1																							
SAN LUIS OBISPO										3			1		25	2			21								11	
SAN MATEO																					1							
SANTA BARBARA	1									5					68				57		1	1					1	
SANTA CLARA	26				1		7								1				4					7			3	
SANTA CRUZ																											1	
SHASTA	32			7		6	8			3	3	5			4	3	6	3	24	1	4		3	3	2		1	5
SIERRA	8			3			1			1							1		1									
SISKIYOU	53			24		16	23			5	22	10	1		11	6	10	6	77		1	1	8	4	17		1	13
SOLANO	7					2																						2
SONOMA	43					1	17					2			1				12	2	15		7					15
STANISLAUS	3						9													1				10			1	
SUTTER																												
TEHAMA	28			77		19	12			13	52				2	5	5	5	65	1			3	1			3	11
TRINITY	62			9		1	7	4		2	2	161	1		4	4	2		52		13		58					7
TULARE	2									21				14	101	16			199	1				2				
TUOLUMNE	8		1		22		3		1							2			1		2	1		2				
VENTURA															12				108									
YOLO	4				2	3											1										2	
YUBA	2			7			1																					
TOTALS	967	3	65	474	111	366	256	42	260	552	331	702	14	145	414	91	366	158	1611	139	341	43	652	128	19	13	502	410

NEVADA	ORANGE	PLACER	PLUMAS	RIVERSIDE	SACRAMENTO	SAN BENITO	SAN BERNARDINO	SAN DIEGO	SAN FRANCISCO	SAN JOAQUIN	SAN LUIS OBISPO	SAN MATEO	SANTA BARBARA	SANTA CLARA	SANTA CRUZ	SHASTA	SIERRA	SISKIYOU	SOLANO	SONOMA	STANISLAUS	SUTTER	TEHAMA	TRINITY	TULARE	TUOLUMNE	VENTURA	YOLO	YUBA	NON-RESIDENT	TOTALS
									6	2		4		24	2						1									220
		1							4	22											11				1				2	67
					14				1	9				1						1							1			59
		4			2			1	4	1					2	1			1	5		12	2					5	4	228
	1				3				6	37				4	1					1	5				1	6			1	149
		2			10				7	8		4							1	1		12						37	6	263
										1																				5
		1																												42
1	2	38			111	1	2		4	20		2		6	2				3	6	4	3					2	3	2	535
	6					1	1	3	1	1					2										58		7				592
	3	7			42			2	12	17	2	3	4	5	2	5			13	17	2	29	17					51	6	423
	2			4	4	1	2	9	63	3	1	9		10		2		2	6	16	15	4		8	4		2	3	1	821
																														1
	3		1				2	1			2																2			173
	5			2			5																		1		1			218
																														3
	1	3		1	38		1	4	58	13		11	1	15	2				39	62	5	10	1		1		2	36	3	901
	2	5	5		8	1		1	9	7	1		1	6	6	5		4	3	6	10	8	9		2			4	5	2 296
	6						2						1								6				3		9			425
1							10	2	3	2		3	1	2	8															260
									74			6	1	1					4	47										367
									2	3		2									2					1				85
	11			2	16		1		249	14	3	31	3	23	3			1	24	194	6	2	7		2	1		5		1475
						1			1	1		1			9						6									67
	6	6			22	1	3	17	12	11	4		4	7	7	8		16	6	33	9	5	8		14		7	4	4	13	510
							2	1	2																	1					36
	9			1	1	7	1	2	26	1	87	8	7	27	69				4							8	1			757
		2		1	15			1	26	4		5		4					67	11	3	1						34		442
63		13			9			1	4					3								5						2	8	1 125
	52																										1			56
		124			50				27	14		1		10	4	1			5	8	3	3							10	1 341
1	5	20	132	3	28	1	1		15	9	2	2		11		1	8		5	7	1	30	12		2			20	8	1 551
	24			158			30	11																		1				323
3						132	2		5	2	2		2	12	11										4					217
	12			4			40																							74
	12			2			3	129						1																169
										17											1									21
	2						2		2		268	2	46	1	1					2					4		1			394
									8			51		7	9				1											77
	7			2				2	4		37		199		8						1			2		33			669
						13			17		1	20		285	11					1										997
	1			1	1				6			7		8	53															78
	3				10	1	1		13	10	1	1	1	8	4	348		17	17	12	4	8	19		6		1	4			612
11	2	8	3		8	1			8			1	1				27					3						1	9	3 101
	14	7		5	47	10	1	6	45	11	1	7	3	29	2	45		999	12	12	7	12	20	5	8		3	11	4	30 1665
					1			1					2						14		1							14	1	45
	3				7			1	110	4	4	7	2	9					3	490	1							1	2	2 751
					1				1	8			3	1							53										91
																						1								1
	18	6	0		28		1	2	23	27			1	13	1	12		5	18	16	17	26	234		8	3		18	10	799
1	7	2		6	13	3	4	5	69	6	5	3		26	12	44		16	8	43	25	4	13	196	5	1		7	7	1 921
	32			1			15	2		1	6	6	2	3							1				314		5			744
					3					31											28				5	103				213
	3						4	1	1	1			5														139			274
					12				3	2									6		1	2			2			75		115
2					3				2													5						31		53
83	254	349	150	193	907	174	136	205	933	320	427	187	530	561	232	472	35	1060	260	981	229	185	342	209	446	18	223	937	122	56 9507

DEER KILLED IN DISTRICTS 2-2½ & 3 AUGUST 1 - SEPTEMBER 14.

	AUG.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	SEPT.	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTALS
ALAMEDA	27	11	5	6	3	3	10	2	3	4	2	5	3	10	2	3	4	—	2	3	8	—	—	1	5	4	1	10	—	2	1	—	1	5	16	7	—	3	3	5	13	9	2	4	12	220
COLUSA	48	27	8	8	5	9	6	6	6	3	2	4	4	8	4	4	5	3	5	5	7	1	5	3	5	1	2	5	1	3	1	1	2	6	8	3	2	6	1	1	4	12	4	6	7	263
CONTRA COSTA	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
FRESNO	10	5	2	2	—	—	3	1	2	3	1	1	—	2	1	1	—	—	—	1	—	4	—	—	—	—	2	—	2	—	—	2	3	1	—	2	1	2	—	1	1	5	1	4	—	66
GLENN	139	57	31	26	18	20	17	8	10	6	10	7	6	13	7	13	5	9	11	12	20	9	5	5	6	8	7	15	6	5	4	13	5	4	21	9	7	4	6	3	5	11	5	8	7	623
KERN	6	1	—	—	1	1	3	2	—	—	1	—	2	1	—	2	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	1	—	2	1	—	—	—	—	2	—	—	—	32
KINGS	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	3
LAKE	148	71	40	25	20	18	42	14	14	18	11	12	17	31	7	7	12	7	5	13	23	11	4	7	10	6	2	28	8	4	4	7	3	10	39	18	11	11	10	16	30	36	19	24	28	901
MARIN	28	8	10	6	6	11	20	4	5	5	5	1	11	25	3	—	7	5	6	12	15	3	4	6	—	4	9	8	3	8	2	5	3	6	18	7	5	8	2	19	13	14	2	8	17	387
MENDOCINO	188	95	57	42	32	35	57	26	22	20	19	16	35	49	18	14	16	14	14	31	55	19	24	17	9	20	19	39	16	13	15	13	20	18	50	38	21	16	23	20	40	55	36	31	48	1475
MERCED	9	1	—	—	—	1	3	1	—	—	1	1	1	4	1	—	1	—	1	1	3	1	—	2	1	2	3	3	1	—	—	—	—	1	1	1	—	—	—	2	2	6	1	3	3	62
MONTEREY	98	50	34	16	27	23	23	12	21	5	9	11	16	20	6	4	6	6	7	16	17	8	5	10	5	8	15	12	10	10	6	6	9	12	19	15	9	15	7	20	17	28	18	30	34	757
NAPA	66	13	15	2	8	12	23	4	4	5	7	5	11	27	2	4	4	8	7	7	22	1	5	3	4	8	4	24	7	4	6	3	7	4	17	12	—	3	6	10	8	22	5	9	14	442
SAN BENITO	28	10	8	7	3	5	10	3	1	3	2	4	5	12	3	1	5	2	2	3	6	1	1	1	1	1	1	5	4	2	2	5	2	3	14	3	4	2	4	3	8	9	1	5	12	217
SAN FRANCISCO																																														
SAN JOAQUIN	7	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	2	1	—	—	1	—	1	—	1	—	3	—	—	1	21
SAN LUIS OBISPO	47	25	13	13	6	14	9	5	5	3	1	4	8	12	2	3	5	5	4	7	10	5	3	4	5	5	4	9	2	9	3	7	4	4	16	6	3	6	5	7	9	19	12	21	25	394
SAN MATEO	8	7	2	—	2	3	5	—	1	3	1	—	—	10	—	1	1	1	—	—	5	—	—	—	—	—	—	2	2	—	2	—	—	1	7	2	—	2	—	2	3	1	1	1	1	77
SANTA BARBARA	103	39	42	22	25	22	29	9	11	8	8	9	16	8	8	6	10	5	6	11	14	3	10	5	8	6	6	11	4	8	2	7	4	11	28	10	5	3	10	16	7	27	12	9	26	669
SANTA CLARA	50	19	19	8	11	10	18	1	4	4	3	3	4	24	3	4	2	4	1	9	7	3	1	2	5	3	3	11	1	5	2	5	3	10	17	11	2	6	5	14	9	20	12	13	26	397
SANTA CRUZ	11	4	1	2	2	3	3	—	—	—	—	—	2	3	1	—	—	1	1	2	2	1	1	—	1	2	2	1	—	—	—	—	1	3	1	5	1	1	—	—	—	1	—	6	—	1	4	45
SOLANO	12	1	—	2	—	—	4	—	—	1	—	—	1	3	—	—	—	—	—	—	2	1	—	—	1	1	1	1	—	—	—	—	—	—	2	—	—	—	—	1	—	6	—	1	4	45
SONOMA	96	31	21	10	17	23	50	11	8	17	8	8	11	28	6	3	4	8	11	10	40	3	5	3	8	15	16	33	4	3	6	8	6	13	34	19	8	7	7	11	18	40	16	19	28	751
STANISLAUS	14	2	2	1	—	1	3	—	—	2	1	2	2	4	—	2	1	1	—	2	4	1	1	1	1	—	1	2	—	2	—	1	1	1	4	1	1	1	—	1	5	11	1	—	2	83
VENTURA	58	23	8	8	7	11	14	3	4	7	8	—	7	11	4	3	4	2	2	2	15	—	4	—	2	—	1	11	—	1	5	5	2	2	18	4	—	—	2	3	4	5	2	4	2	274
YOLO	15	9	2	1	3	—	6	3	2	3	2	—	3	6	—	—	—	2	1	2	6	—	1	—	—	—	2	4	2	2	—	—	1	1	9	4	—	1	—	4	2	10	2	3	1	115
TOTALS	1214	527	320	207	196	226	359	118	123	120	103	93	165	311	78	75	92	83	88	148	286	71	80	70	80	94	102	237	73	82	82	91	81	114	341	175	80	97	91	164	201	353	156	206	304	8337

DEER KILLED IN DISTRICTS 1¼ SEPTEMBER 1 - OCTOBER 15.

	SEPT.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	OCT.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTALS
DEL NORTE	5	5	—	2	1	—	—	1	—	—	3	1	1	2	—	—	1	3	—	2	—	—	—	2	2	1	1	—	1	—	1	—	1	—	—	2	1	—	1	—	1	—	—	1	—	42
HUMBOLDT	87	39	39	69	32	36	23	26	14	14	23	10	6	12	9	10	8	21	5	9	7	6	8	13	14	10	9	13	13	8	15	23	12	9	13	13	4	17	25	14	10	18	11	31	13	821
SISKIYOU	228	125	111	112	49	39	31	33	24	46	32	15	21	18	24	21	26	41	13	26	12	26	15	16	30	9	11	15	11	16	26	29	19	19	19	31	19	32	43	30	29	38	42	34	39	1665
TOTALS	320	169	150	183	82	75	54	60	38	60	58	26	28	33	33	31	35	65	18	37	19	32	23	31	46	20	21	29	24	25	41	52	31	28	34	45	23	50	68	45	39	56	53	66	52	2528

DEER KILLED IN OTHER DISTRICTS SEPTEMBER 16 - OCTOBER 15.

	SEPT. 16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	OCT. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTALS
ALPINE	17	10	5	3	4	4	4	1	1	—	—	1	1	—	—	—	1	—	—	3	1	—	2	1	—	1	—	—	1	—	67
AMADOR	7	10	11	—	5	—	—	3	—	5	1	2	—	—	1	—	2	—	1	1	2	1	2	1	—	1	1	1	1	—	59
BUTTE	29	10	25	1	8	5	7	4	4	16	2	6	1	—	2	8	12	2	8	4	4	3	4	15	5	3	7	5	11	17	228
CALAVERAS	32	12	25	6	1	3	1	3	3	6	2	—	—	2	1	4	10	2	—	2	3	2	—	6	2	—	5	2	6	8	149
ELDORADO	110	44	56	10	14	15	9	9	11	31	6	5	4	9	7	11	22	—	9	4	7	10	14	21	10	13	11	19	26	18	535
FRESNO	96	47	34	27	26	17	19	15	16	14	18	5	11	8	11	13	11	7	4	10	13	10	10	19	11	7	10	14	14	9	526
IMPERIAL	—	—	—	—	—	—	—	—	—	-	—	-	-	1	—	—	—	—	—	—	—	—	—	—	—	-	—	—	—	-	1
INYO	22	31	11	10	8	7	4	3	1	3	1	4	2	3	2	2	10	3	—	2	3	4	2	5	4	3	4	2	5	12	173
KERN	40	18	10	9	9	2	2	2	1	7	3	5	4	4	3	3	5	4	1	3	12	3	3	9	3	1	2	4	10	4	186
KINGS																															
LASSEN	55	16	42	12	14	7	7	6	7	9	6	9	3	5	2	3	12	4	5	5	5	4	3	5	11	6	7	11	7	8	296
LOS ANGELES	78	32	43	5	3	7	3	4	9	29	7	10	6	7	10	8	29	3	5	11	7	6	10	31	4	12	8	13	13	12	425
MADERA	59	29	19	8	4	5	4	9	5	8	3	4	1	2	3	5	3	6	5	3	4	4	10	16	4	3	8	9	9	8	260
MARIPOSA	15	8	10	2	1	2	3	3	—	3	—	2	2	1	—	1	3	—	2	3	1	2	2	7	—	1	8	1	4	8	95
MERCED	3	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	5
MODOC	84	61	44	18	25	26	11	12	15	14	5	9	11	13	11	3	12	4	5	5	13	9	14	19	9	12	8	13	17	8	510
MONO	5	4	3	—	1	1	—	—	—	4	1	—	2	1	1	—	2	1	1	1	—	1	1	1	1	—	1	1	1	1	36
NEVADA	10	5	9	4	3	5	3	2	1	8	—	—	5	3	3	6	9	—	3	—	1	1	3	11	4	3	2	8	3	10	125
ORANGE	8	3	—	2	—	1	—	1	1	4	1	1	4	—	1	—	6	3	2	2	1	—	—	2	1	2	1	3	1	5	56
PLACER	80	40	29	16	5	9	6	5	10	18	3	4	5	5	2	5	14	5	6	8	5	6	5	13	3	4	3	8	10	9	341
PLUMAS	82	50	39	24	26	25	11	18	15	25	4	9	16	4	10	12	14	7	8	14	11	9	21	28	14	6	12	14	15	8	551
RIVERSIDE	105	27	15	19	4	4	3	6	8	7	3	1	5	4	4	7	10	2	2	5	5	4	11	11	5	4	6	15	13	8	323
SACRAMENTO																															
SAN BERNARDINO	17	4	7	2	3	1	2	1	1	2	—	2	1	1	1	2	6	2	1	1	—	2	1	2	—	—	2	3	4	3	74
SAN DIEGO	26	7	7	1	7	1	4	3	5	8	5	4	2	2	5	3	11	2	4	3	2	4	8	16	3	3	7	6	6	4	169
SAN JOAQUIN																															
SHASTA	80	38	27	15	21	19	18	13	20	23	17	11	7	11	12	13	23	10	14	9	14	13	21	32	10	18	21	20	36	26	612
SIERRA	7	9	17	1	3	4	1	1	2	3	1	1	2	—	4	1	3	2	1	—	1	4	5	11	3	1	1	3	3	6	101
STANISLAUS	3	—	1	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	8
SUTTER	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
TEHAMA	85	46	49	31	24	16	18	20	19	17	7	13	10	15	8	16	25	13	13	25	26	16	24	46	29	32	35	29	52	40	799
TRINITY	94	41	44	58	32	32	19	21	22	32	27	24	26	23	24	24	22	20	24	21	22	18	34	35	34	26	36	14	42	30	921
TULARE	171	96	57	35	27	35	29	27	16	15	14	20	5	6	3	7	16	10	9	8	13	8	19	22	14	10	4	9	16	23	744
TUOLUMNE	31	21	21	12	7	4	5	3	4	14	1	2	1	3	3	2	11	3	5	1	5	2	4	12	5	3	2	8	9	9	213
YUBA	4	2	3	—	3	—	1	3	1	2	3	—	—	2	1	1	6	—	—	2	—	—	1	6	—	—	3	—	5	4	53
TOTALS.	1455	722	663	338	289	258	194	198	198	327	141	154	137	135	135	160	311	116	139	156	181	146	234	403	189	175	215	235	340	298	8642

6—58645

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1927

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore									1,051
Anchovies							15,725		3,830
Barracuda									16
Bonito									40
Carp				735	6,878	2,383			
Catfish		23,466		1,957	63,846	52,908			
Cultus Cod	1,251	1,820					84,173	7,828	66,781
Eels							5		
Flounders	595	26,360				36	131,529	4,764	475
Grayfish							70,575		3,775
Hake							3,427		
Halibut	104,173	4,030					2,258	786	1,794
Hardhead					21,092				
Herring	1,057		251,460				87,520		
Kingfish							7,225	170	9,285
Mackerel							138	434	359,306
Mackerel—Horse									37,669
Mullet									
Perch	1,778		11,022				6,674	500	1,924
Pike				54	146	845			
Pompano									
Rock Bass									
Rockfish	25,173	8,970	162				230,107	88,039	447,045
Sablefish	197,367						64,976	6,018	32
Salmon	150,514			1,323	582	1,356			
Sandabs		11,440					193,248	3,828	2,429
Sardines							11,490,318		28,839,489
Sculpin								68	60
Sea Bass—Black									
Sea Bass—White			1,698				3,789	1,113	483
Shad				25	773	1,491			
Shad—Buck					100				
Sheepshead									
Skates							52,167	500	1,479
Skipjack								53	
Smelt	8,360		8,345				2,339	12,889	2,765
Sole		76,740					2,457,823	32,043	40,927

Splittail					2,106	1,408			
Striped Bass				6,303	19,458	38,664	163		
Suckers					5	5			
Swordfish									
Tomcod									
Tuna—Bluefin							125		
Tuna—Yellowfin									
Turbot									
Whitebait			889				75		
Whitefish	3,546						3,827		
Yellowtail									
Miscellaneous	25				450	13	1,800	7,888	4,243
Total fish	493,839	152,826	273,576	10,397	115,436	99,109	14,910,006	166,921	29,824,898
Crustaceans:									
Crabs	[1]19,080	[2]96	[3]2,112				[6]624,816	[7]127,512	[8]336
Shrimps			437,311				85,728		
Spiny Lobsters									
Mollusks:									
Abalones									706,381
Clams—Cockle			59						
Clams—Mixed	4,261		10,254						
Clams—Pismo									
Clams—Softshell			14,357			11,550			
Cuttlefish							153		294
Mussels							55		
Oysters—Eastern			[4]32,277				[6]172,425		
Squid									376,886
Totals	517,180	152,922	769,946	10,397	115,436	110,659	15,793,183	294,433	30,908,795

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

[1] 795 dozen.
[2] 4 dozen.
[3] 88 dozen.
[4] 146,715 shell oysters.
[5] 26,034 dozen.
[6] 783,750 shell oysters.
[7] 5,313 dozen.
[8] 14 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1927

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from South of the International Boundary line brought into California via San Pedro	Fish from South of the International Boundary line brought into California via San Diego	Total
Albacore		289,155	15,102	887	306,195	26		26
Anchovies		1,338			20,893			
Barracuda	3,012	220,213	674	27,127	251,042	784,451	65,802	850,253
Bonito	458	186,196	947	28,119	215,760	559,808	24,685	584,493
Carp					142 177			
Catfish					139,887			
Cultus Cod	275				162,128			
Eels					5			
Flounders		10			163,769			
Grayfish		31,931			106,281			
Hake					3,427			
Halibut	60,283	55,813	443	3,928	233,508	44	11,668	11,712
Hardhead					21,092			
Herring				12,919	352,956			
Kingfish		79,766		90	96,536			
Mackerel	4,629	1,236,527	36,314	105,668	1,743,016			
Mackerel—Horse		126,085			163,754	4,837		4,837
Mullet			97	683	780	3,484	85	3,569
Perch	211	20,642	7	285	43,043	185		185
Pike					1,045			
Pompano		714		36	750			
Rock Bass	2,670	39,908	33,143	13,290	89,011	1,964	425	2,389
Rockfish	22,606	374,257	91,656	176,302	1,464,317	519		519
Sablefish	67				268,460			
Salmon					153,775			
Sandabs		2,607	28		213,580			
Sardines	27	40,138,389	965	1,186,450	81,655,638			
Sculpin	18	12,846	253	5,535	18,780			
Sea Bass—Black	2,659	10,439	10,691	11,234	35,023	12,623	134,700	147,323
Sea Bass—White	15,298	50,721	1,221	9,048	83,371	15,034	54,316	69,350
Shad					2,289			
Shad—Buck					100			
Sheepshead	387	43,971	404	26,671	71,433			
Skates		9,253			63,399			
Skipjack		720,267	180	11,754	732,254	4,277,050	4,651,174	8,928,224
Smelt	3,797	150,298	58,863	4,766	252,422			
Sole	19,477	8,310		1,532	2,636,852			
Splittail					3,514			
Striped Bass					64,588			

Suckers					10			
Swordfish		2,008		20,050	22,058			
Tomcod					125			
Tuna—Bluefin		776,726	17		776,743			
Tuna—Yellowfin		411,885	135	2,685	414,705	4,465,274	5,184,060	9,649,334
Turbot					964			
Whitebait					7,373			
Whitefish		59,588	21	20,134	79,743	7,017	7,280	14,297
Yellowtail	19	37,912	858	146,372	185,161	1,068,843	930,201	1,999,044
Miscellaneous	223	28,188	712		43,542	7,979		7,979
Total fish	136,116	45,125,963	252,731	1,815,565	93,377,383	11,209,138	11,064,396	22,273,534
Crustaceans:								
Crabs					[9]773,952			
Shrimps					523,039			
Spiny Lobstersz	79,113	173,822	23,079	132,701	408,715		341,970	341,970
Mollusks:								
Abalones	3,520				709,901			
Clams—Cockle					59			
Clams—Mixed					14,515			
Clams—Pismo	6,020				6,020			
Clams—Softshell					25,907			
Cuttlefish		85	18		550			
Mussels					55			
Oysters—Eastern					[10]204,702			
Squid					376,886			
Totals	224,769	45,299,870	275,828	1,948,266	96,421,684	11,209,138	11,406,366	22,615,504

[9] 32,248 dozen. [10] 930,465 shell oysters.

CORRECTION

On account of delayed reports having reached this office after the original report was made up for publication, the following corrections should be made in the July, August and September, 1927, report of the catch of fish in California published in the January, 1928, Vol. 14, No. 1, issue of CALIFORNIA FISH AND GAME, pages 102 to 105.

Del Norte-Humboldt counties should read:

Salmon	722,608
Total fish	1,126,108
Total	1,234,190

Alameda-Contra Costa counties should read:

Catfish	29,040
Salmon	277,236
Striped bass	131,810
Total fish	456,543
Total	470,018

Solano-Yolo counties should read:

Catfish	4,770
Total fish	188,306
Total	188,306

San Luis Obispo-Santa Barbara-Ventura counties should read:

Rockfish	29,970
Total fish	271,250
Total	295,605

58645 5-27 9500

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